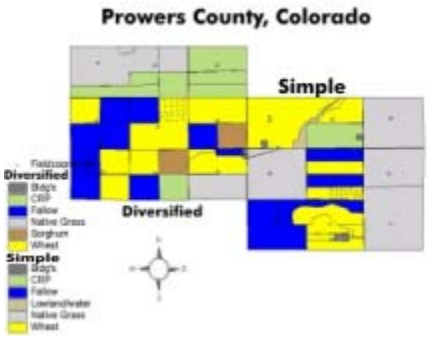
1. Demonstration Component Summaries

a. Colorado Demonstration Sites

Prowers County, CO
Phase II, Year 1 (2002-2003)
Written by Laurie Kerzicnik



Crops Involved in the Rotation

Simple-rotation field -Wheat

The field to the right is a grower who uses simple rotation. He has strips of wheat/fallow, and 80 acres were used for sampling.

Diversified Field-Wheat & Sorghum

The grower to the left grows wheat and grain sorghum, which is a diversified field. The wheat sampled was 160 acres of Prairie Red. The sorghum was also 160 acres.

Aphid Overview

In the wheat, aphids were sampled monthly from March through June. The dominant aphid for both cooperators was *D. noxia* (Table 1). *Rhopalosiphum padi* was also present in low densities. The grower of the simple-rotation field had more *D. noxia* in his field in early June, but aphid densities were extremely low and far from damaging levels. It is difficult to compare aphid densities with both fields, as populations were minimal.

Table 1. No. aphids for either field in wheat. Total no. aphids= sum of aphids for 25, 1-ft rows, measured by Berlese funnels.

Date	Aphid	Diversified	Simple
3/26/2003	*D. noxia*	4	14
	S. graminum	0	0
	R. padi	0	0
4/24/2003	*D. noxia*	77	15
	S. graminum	0	0
	R. padi	0	18
5/14/2003	*D. noxia*	33	36
	S. graminum	0	0
	R. padi	20	3
6/10/2003	*D. noxia*	53	183
	S. graminum	0	1
	R. padi	0	0

In the sorghum, aphids were sampled during late whorl, flowering, and grain fill in the diversified field. *Schizaphis graminum* was present in early August and were replaced by *R. maidis* in October (Table 2). Aphid numbers were relatively low; however, greenbug damage was evident by red spotting on several of the plants.

Table 2. No. aphids per 10 benchmark samples at the diversified field (grain sorghum) (3 plants per benchmark).

	Crop Stage	*S. graminum*	*R. maidis*
8/12/03	Late Whorl	236	0
9/15/03	Flowering	10	0
10/8/03	Grainfill	0	250

Natural Enemies

In the wheat, predators were abundant. The major predators are shown in Table 3. Spiders comprise the greatest number of predators, followed by nabids, coccinellids, and minute pirate bugs, *Orius* sp. This pair of demonstration sites is interesting because predator densities are higher with the diversified grower in all categories.

Table 3. No. predators in wheat for either field. Each date represents a total for 625 sweep net samples per site (at 25 points). (D=Diversified field; S=Simple field)

	Nabidae		Spiders		Coccinellidae		Coccinellidae (imm.)		Green Lacewing		*Orius* sp.	
Date	***D***	***S***	***D***	***S***	***D***	***S***	***D***	***S***	***D***	***S***	***D***	***S***
5/14/03	174	149	564	430	49	10	2	18	0	0	8	8
5/28/03	194	150	237	138	42	27	11	5	3	0	7	9
6/09/03	40	58	148	99	14	9	1	0	0	0	0	0
6/23/03	20	10	49	26	0	0	0	0	1	0	0	0
Total	**428**	**367**	**998**	**693**	**105**	**46**	**14**	**23**	**4**	**0**	**15**	**17**

For sorghum, predators were sampled during late whorl, flowering, and grainfill. Fifty sorghum plants were sampled at each benchmark. Both coccinellids and the spider mite destroyer, *Stethorus punctillum*, were present at all sampling times; however, densities were very low.

Other Pests

The wheathead armyworm appeared in the diversified grower's field on May 14, 2003 in the wheat. Populations increased in sweep net samples for both cooperators after this date (Table 4). Although little is known about the wheathead armyworm, it is known that the first generation larvae feed on foliage before heading and feed on the heads as they develop.

Table 4. No. wheathead armyworms per 625 sweeps for each date and cooperator. (S=Simple field; D=Diversified field)

	S	D
5/14/03	0	2
5/28/03	1072	514
6/9/03	448	317
6/23/03	94	123

In the sorghum, there weren't any major pests present besides aphids. Sampling for headworms was conducted late in the sorghum crop stage, but no headworms were found.

Weeds

Weeds were sampled before wheat jointing, before harvest, and after harvest both within the field and along the borders. Weed densities were close to zero before jointing both within the field and the border for both fields. Before harvest, the conventional grower's field had very few weeds. The diversified grower's field, however, had heavy bindweed infestations in the field but no significant weeds along the border. After harvest, weeds were very high within both fields. Along the field borders, the conventional grower had heavy infestations of *Bromus* sp. and jointed goatgrass along the west. The diversified grower had high infestations of *Bromus* sp. along the southern and eastern borders of his field.

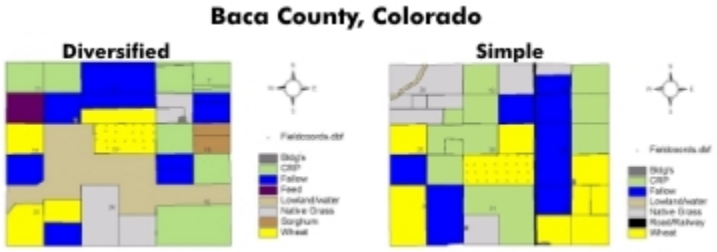
Although we did not sample weeds in sorghum, it should be noted that field sandbur densities were extremely high. The sandburs were present in every area of the field, including the benchmark areas.

Summary

The notable aspect of this pair of sites is the greater density of predators with the diversified grower. The aphid numbers were at a minimum for both cooperators. The wheathead armyworm was present in high densities in late May/June at both sites. Weed densities were high close to harvest within the field, and *Bromus* species and jointed goatgrass were present along the field borders around harvest time.

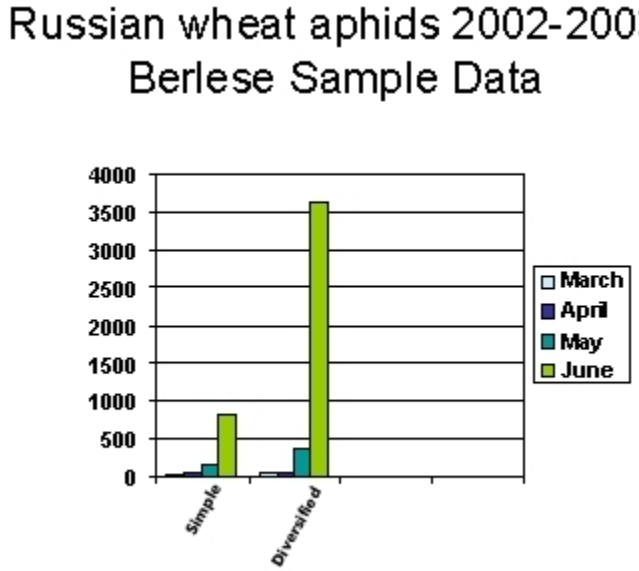
We have made an effort to broaden communications with both growers. When the project started, I met the diversified grower for breakfast to discuss the project. We visited the conventional grower at his home to ask questions and describe the goals of the research. We have provided both cooperators with soil and climatic data for the year. Both cooperators seem genuinely interested in the project and the pests, predators, and weeds we find.

Baca County Colorado
Phase II, Year 1 (2002-2003)
Written by Hayley R. Miller

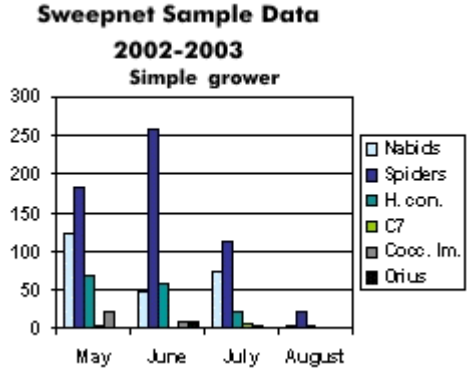


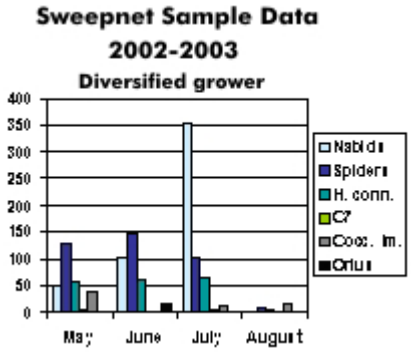
Crops involved in rotation: Wheat-Fallow, Wheat-Sorghum-Fallow
The field on the right is our simple-rotation field, where the cooperator is growing Hard Red winter wheat, Prairie Red and Halt. The field on the left is our diverse field, where the cooperator is growing Hard Red Winter wheat (Certified Prairie Red), rotated with grain sorghum and fallow.

Russian wheat aphid status: Russian wheat aphids were present at both farms. The simple-rotation field had little Russian wheat aphid pressure at the end of May and in June. A biotype of the Russian wheat aphid was found in the diversified field. Four months of Berlese sample data shown below were taken from 25 1ft. row samples at each location. When aphids were found samples were taken and put in emergence canisters, no parasitoids were found at either site. This year drought was a problem in wheat production.



Natural enemies:





Twenty-five 180 degree sweeps were taken at each of the 25 points at each location. The majority of natural enemies were nabids, spiders, coccinellids and minute pirate bugs.

Other pests: Simple-In addition to Russian wheat aphids the conventional field had eight Bird Cherry Oat aphids and one greenbug in the April Berlese samples. The table below gives the Berlese samples counts for Banks Grass Mite, Brown Wheat Mite and Thrips.

	27 March	21 April	13 May	9 June
BGM	0	8	6	0
BWM	0	0	12	0
Thrips	0	84	833	676

Twenty-five 180 degree sweeps were taken at each of the 25 points at each location and the number of Wheat Head Army Worms caught is shown in the table below.

	13 May	27 May	10 June	24 June
WHAW	0	70	452	254

Diverse-In addition to Russian wheat aphids the diversified field had 23 Bird Cherry Oat Aphids in the June Berlese samples. The table below gives the Berlese samples counts for Banks Grass Mite, Brown Wheat Mite and Thrips.

	27 March	21 April	13 May	9 June
BGM	0	39	8	0
BWM	0	0	33	0
Thrips	0	275	1569	1699

Twenty-five 180 degree sweeps were taken at each of the 25 points at each location and the number of Wheat Head Army Worms caught is shown in the table below.

	13 May	27 May	10 June	24 June
WHAW	0	341	1305	188

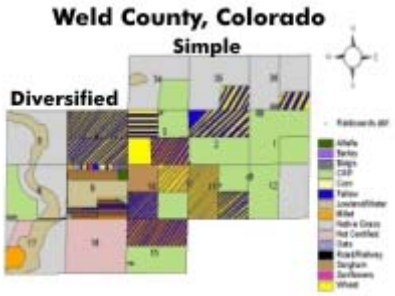
Weed situation in wheat: Zero to fourteen days before jointing there was little weed pressure at either site. Zero to fourteen days before harvest the simple-rotation field had 3 to10+ weeds at each of the 25 sampling points and wheatgrass and jointed goat grass pressure on east and west borders of the field. Zero to 14 days after harvest this field had 1 or 2 patches of volunteer wheat on his west border and patches of *Bromus* species ranging from 1 or 2 plants to 10 or more on north, east and west borders. Zero to fourteen days before harvest the diversified field had 3 to10+ weeds at each of the 25 sampling points and little *Bromus* pressure on the west border of the field. Zero to 14 days after harvest the diversified had high *Bromus* pressure on south, east and west borders and jointed goat grass pressure on all borders.

Sorghum: Fifteen plants were examined at ten points throughout the field and sampled for aphids and beneficial insects. At late whorl stage corn leaf aphid pressure was high at the diversified field, averaging 30 aphids per each of the 15 plants at each of the 10 locations. Nabids, lacewings immature and adults stages, flea beetles, spiders, tenebrionids, coccinellids, plants hoppers, minute pirate bugs, and thrips were all observed in small numbers on the sorghum plants at late whorl and flowering stages. Corn leaf aphid pressure was less at flowering stage averaging 10 aphids per plant. Sorghum was harvested before corn earworm and fall armyworm could be sampled, yield was not obtained due to early harvest.

Weed situation in sorghum: Occasional sandbur nothing of concern.

Summary of overall findings and important observations: A biotype of the Russian wheat aphid was found in the diversified field in Baca County. Wheat head army worm counts were high at both sites. A breakfast meeting was held in Springfield Colorado at the Longhorn Steakhouse to discuss the project status with both growers. The grower with the diversified field was unable to attend due to sorghum planting. The grower with the simple-rotation field, Laurie Kerzicnik and I attended the meeting and relayed important information to both parties such as planting dates, yields, insects and weeds present. Both cooperators are showing interest and enthusiasm in this project. Yield information is not yet complete for both cooperators.

Weld County, CO
Phase II, Year 1 (2002-2003)
Written by Laurie Kerzicnik



Crops Involved in the Rotation

Simple Rotation-Wheat

The grower with the simple-rotation field maintains the wheat/fallow rotation for this pair of demonstration sites. His wheat is in a half-section of stripped wheat/fallow, which equals approximately 160 acres of wheat. The variety planted is primarily Scout 66, although there is a variety trial with several wheat varieties in one of the wheat strips.

Diverse field-Wheat, Millet & Sunflower

This is the grower with the diversified field for this county. This is a unique site because it is part of a USDA/CSU diversified cropping systems study. The purpose of the study is to determine the effect of diverse cropping systems on integrated pest management and the effect of shorter fallow periods on cropping systems.

There are four rotations in this study-wheat/fallow, wheat/millet/fallow, wheat/wheat/corn/corn/sunflower/ fallow, and opportunity cropping. The wheat/fallow and wheat/millet/fallow are rotations that are typically seen in Colorado. For this study, we used four plots of wheat and four plots of millet that were in the wheat/millet/fallow rotation. The plots are replicated such that there are four replications of wheat, four of millet, and four of fallow.

Wheat: We divided our 25 sampling points among the four wheat plots.

Sunflower: This is part of the wheat/wheat/corn/corn/ sunflower/fallow rotation. There were four sunflower plots, and we sampled 15 plants in each plot.

Millet: The millet was not sampled in this study. The millet was harvested due to adverse conditions and was sprayed before the first sampling could occur.

Overview of the Aphid

Aphids were sampled from April through June. The primary aphid is the Russian wheat aphid, *Diuraphis noxia* Mordvilko. The greenbug, *Schizaphis graminum* Rondani, and the bird cherry oat aphid, *Rhopalosiphum padi* L, were also present, but their populations were extremely low. Table 1 shows *D. noxia*, *R. padi*, and *S. graminum* and their densities for each grower. The diversified field had a peak of *D. noxia* in late May where the simple-rotation field had higher densities in June. The simple rotation also had a greater density of *R. padi*.

Table 5. Aphids for Weld County Cooperators, diversified and simple rotation in wheat. Total # aphids=sum of aphids for 25, 1-ft rows, measured by Berlese funnels. (D=Diversified field; S=Simple field)

Date	Aphid	D	S
4/15/2003	*D. noxia*	9	4
	S. graminum	0	0
	R. padi	0	0
5/22/2003	*D. noxia*	911	125
	S. graminum	0	0
	R. padi	0	11
6/26/2003	*D. noxia*	634	889
	S. graminum	4	2
	R. padi	3	34

Natural Enemies

For the diversified and conventional farmers, natural enemies were prevalent in wheat. There are no apparent differences in natural enemy densities between cooperators. Table 2 shows the major predators for wheat from 5/19/03-7/9/03. The dominant natural enemy for both cooperators was *Orius* sp. (minute pirate bug). When populations of *Orius* diminished, nabids, spiders, and coccinellids densities remained constant. The green lacewing was present but at low densities.

Table 6. Predators in wheat for both diversified and conventional. Each date represents a total for 625 sweep net samples per site (at 25 points). *The wheat in the diversified field was harvested before 7/9/03, so there were no sweep net samples for this time. (D=Diversified field; S=Simple field)

	Nabidae		Spiders		Coccinellidae		Coccinellidae (imm.)		Green Lacewing		*Orius* sp.	
Date	***D***	***S***	***D***	***S***	***D***	***S***	***D***	***S***	***D***	***S***	***D***	***S***
5/14/03	6	8	13	14	3	15	0	1	1	0	282	401
5/28/03	23	43	29	15	10	26	2	0	3	0	54	8
6/9/03	20	2	31	11	14	13	0	28	0	0	0	2
6/23/03	*	5	*	15	*	12	*	10	*	0	*	1
Total	**49**	**58**	**73**	**55**	**27**	**66**	**2**	**39**	**4**	**0**	**336**	**412**

Other Pests

In the wheat, brown wheat mites, *Petrobia latens* Mueller, were found at both sites but densities were very low. Thrips were also found at low densities.

For sunflower, surveys were taken twice in August 2003 before the late bud stage to look for the headclipper moth and the grey and red sunflower weevils. The headclipper moth was not present, and the grey and red weevil populations were at a minimum (averaging less than one per head). Sunflower headmoths were sampled two weeks after the plants reached the 5.9 stage, and the headmoths averaged 10-50 per head in the four benchmark areas. At plant maturity, stem weevils and borers were sampled in the stalk. Stem weevils and stem borers densities were low, averaging less than five per head. Overall, the sunflowers looked relatively healthy for dryland cropping, showing little sign of pest infestation or damage.

Weeds

Weed counts were conducted before wheat jointing, before harvest, and after harvest. Before wheat jointing, there were almost no weeds present within either of the growers' fields or

along their field borders. Before harvest, weeds were consistently high within the simple-rotation field, averaging about 10 weeds per ½ meter squared. In this field border, *Bromus* sp., jointed goatgrass, and volunteer wheat densities were high. The diversified field had fewer weeds at this time, with an average of three weeds per ½ m^2. However, the field did not have any significant weeds along the field borders. After wheat harvest, weeds were numerous in the conventional grower's field within the 10 most westerly points but declined to about three weeds per ½ m^2 for the remaining 15 sampling points. The field borders maintained high densities of *Bromus* sp., jointed goatgrass, and volunteer wheat. Weeds in the diversified field remained at about three per ½ m^2 throughout the field and low around the field borders.

Summary

For this pair of sites, aphid and natural enemy densities were comparable between the fields. Weed densities were somewhat higher before and after harvest within the field and along the field border for the simple-rotation field. Other pest populations remained low at both sites. Although the millet was harvested before samples could be taken, it does represent the opportunistic approach that most growers take when adverse crop conditions exist.

We have taken measures to extend communications with the cooperators. At the start of the project, we met the grower of the diversified field for breakfast to talk about the project and the work we would conduct in his field. At the beginning of this year, Hayley Miller and I helped the grower of the simple-rotation field plant CSU wheat variety trials at the site where we are sampling; he needed two extra hands to help load the seed. In addition, we have sent both cooperators copies of the soil and climatic data collected at their sites. These extended interactions have helped to establish good contacts with the cooperators and give the project a good name. By providing data and help when necessary, I believe we are returning the favor for the use of their fields. Both growers have taken an interest in the project, attending field days, asking questions while we are in the field, and responding to our information requests.

b. Texas Demonstration Sites

Phase II, Year 1 (2002-2003)
Written by Mustafa Mirik, Jerry Michels, Johnny Bible, Shana Camarata, Debi Owings, Roxanne Shufran, Sabina Kassymzhanova-Mirik, and Lana Castleberry

General Introduction

Prior to the wheat-growing season in 2002, we contacted five growers in order to locate five suitable dryland winter wheat and alternative crop fields in the Texas Panhandle. Five farmers agreed to conduct the AWPM study in their fields. Two fields are situated south of the Canadian river, in Deaf Smith and Swisher Counties. The three remaining fields are located north of the Canadian river, in Moore, Hutchinson, and Ochiltree Counties (Figure 1 and Table 1).

After locating the five AWPM fields, soil maps of the fields were obtained from county soil survey maps. Four 100x100 ft benchmarks were established based on changes in soil type and slope in each field. These benchmarks were selected in order to represent the major soil conditions and other possible variations in the fields. Soil fertility and moisture samplings were taken within each of the four benchmark areas in the fields.

Coordinates from the corners of the benchmarks and the fields were taken with a pocket PC and GPS receiver using the SiteMate program. The wheat and sorghum fields were divided into 25 and 10 equally-sized quadrats using 5x5 and 2x5 grid patterns, respectively. Sampling points were located in the center of the quadrats using GPS in both sorghum and wheat fields. Each sampling point was marked by a flag to exactly locate the sampling points at subsequent sampling dates. Mini weather stations were placed in all fields to record temperature and rainfall. Recording time interval was set to 15 minutes. Volunteer wheat, associated insects, and weed surveys in wheat, sorghum, and adjacent fields were conducted in each field 0-14 days before planting and after harvest. Wheat sampling for aphids, predators, parasitoids, and weeds started and continued biweekly after wheat came up as long as the weather conditions permitted. Data collection in the sorghum fields began in mid-July.

Throughout this report we present maximum and total numbers of individual insects and weeds by adding field, berlese, and sweepnet counts for each sampling date. Maximum number is the highest number of species found at one of sampling points and total is number of individual species found at all study plots. This permits to gain general information on the situation in the fields throughout the growing season.

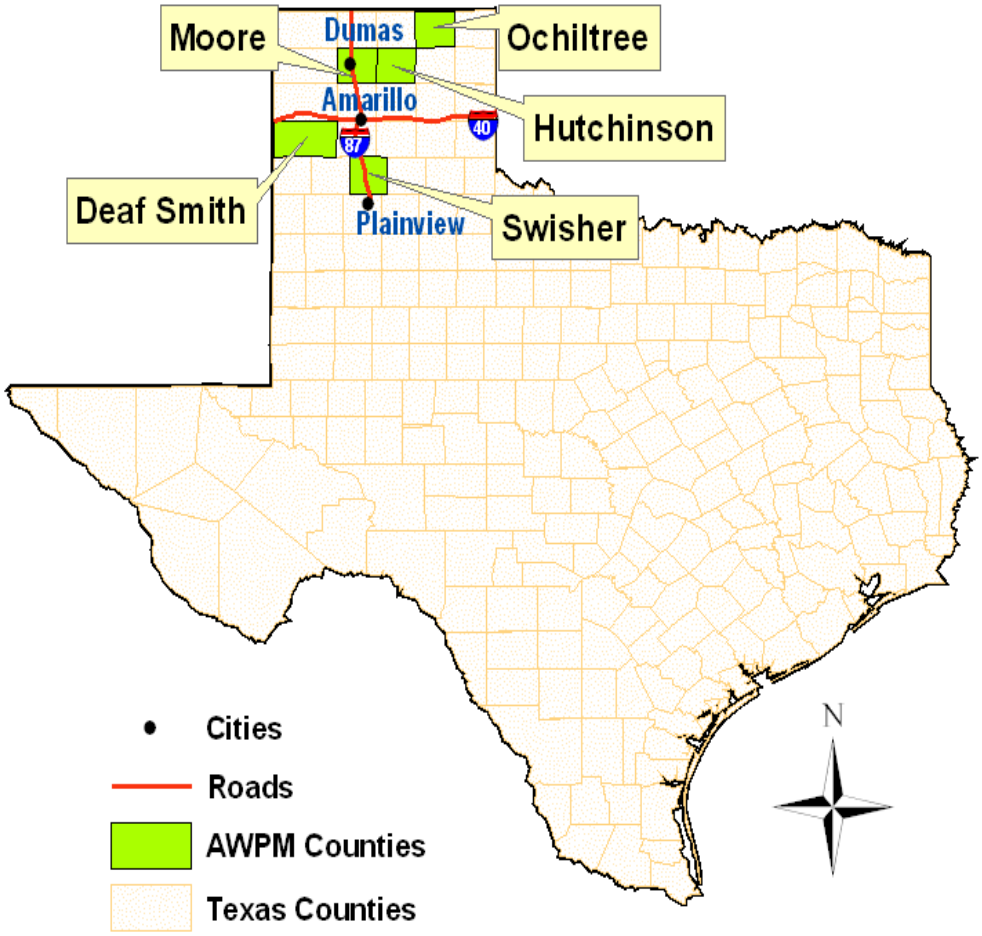


Figure 1: The locations of the AWPM counties where demonstration sites are located.

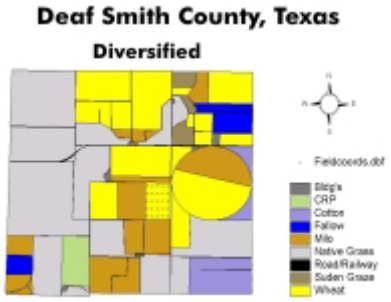
Although we hesitate to make blanket statements regarding this first year's results, it should be noted that the Texas Panhandle experienced sever drought and unusually high temperatures in 2002-2003. This is a continuation of a drought situation that seems to be continuing in 2003-2004. Although some fields received moisture during the year, these events were sporadic and rainfall was usually followed by long period of dry weather. We believe that this needs to be taken into account, and that this severe drought most likely had a significant impact on the data we collected. Hopefully data collected in subsequent years will all a better evaluation of the impact of the AWPM program if climatic conditions return somewhat to normal. We believe that extrapolations of this year's results are to be made with caution.

Table 1: Specific location, cooperator, crop practice, sampled crop and area of the AWPM fields.

County	Section	Block	Crop Rotation	Area Owned by Cooperator (ac)	AWPM Field (ac)	Crop Practice	Wheat Sampled in 02 & 03 (ac)	Sorghum Sampled in 03 (ac)	Wheat being Sampled in 03 (ac)
Deaf Smith	2	7	Diversified	4500	192	w-s-w	102	89	129
Hutchinson	20	M16	Diversified	4480	282	w-s-w	109	173	
Moore	389	44	Simple	3630	319	w-f-w			
Ochiltree	930	43	Simple	640	325	w-f-w	152		173
Swisher	90	M8	Simple	5000	162	con w			162

w- wheat, s – sorghum, f – fallow, con w – continues wheat

Deaf Smith County Wheat and Sorghum Fields



Deaf Smith County is in the western part of the Panhandle of Texas The County consists of 964,480 acres or about 1,500 square miles. It is rectangular and about 50 miles long and 30 miles wide. Elevations range from about 4,450 feet on the western edge of the county to about 3,650 feet along Tierra Blanca Creek. The city of Hereford is the largest city in the county. Wheat and grain sorghum are the main crops. Most of the northwestern part of the county consists of ranches.

The climate of Deaf Smith County is semiarid. During periods of drought, dryland crops produced little or no yield. These droughts are followed by years when rainfall is sufficient for favorable yields. The average annual rainfall is about 18.04 inches. The average annual temperature is 57.2°F. The soil series in the AWPM field in Deaf Smith County are Drake (DrD), Olton (OcB), Pullman (PmA and PmB), and Zita (ZcB). The point coordinates of the southeast corner of the AWPM fields are -102.257 (longitude) and 35.089 (latitude) with an elevation of about 3,806.4 feet.

This field, total area of 320.53 acres, was divided into three adjacent areas. In 2002, winter wheat was planted in 102 acres and sampled during that growing season. One hundred and eight bags of TAM 110 wheat seeds were delivered to the cooperator prior to wheat planting in 2002. In the summer of 2003, sorghum was sampled in 89 acres. Winter wheat was planted in 129 acres and is being sampled in the fall of 2003. Eighty bags of TAM 110 wheat seed were delivered to the owner before wheat planting in 2003.

Field bindweed was found in the field. Johnsongrass, crested wheatgrass, jointed goatgrass, and brome were found at the field borders (Table 2). Table 2 contains sampling dates, wheat growth stages, and overall information about species found in this field. During the entire growing season, few greenbug, corn leaf aphid and birdcherry oat aphid were found. There was a high amount of Russian wheat aphid, nabid, spider, armyworm, and convergent ladybeetle in late April and May, 2003. Rice root aphid, brown wheat mite and seven spotted ladybeetle rarely occurred in this field.

Counts were taken in the sorghum field weekly during the entire growing season. Pigweed, field bindweed, and Johnsongrass were the common weeds in the sorghum field (Table 3). Corn leaf aphid was found during the entire growing season (Table 3). Density of corn leaf aphid reached the highest amount in August. Greenbug and fall armyworm were rarely found. Density of nabids, convergent ladybeetles, and orius was high during the early and mid-growing season while green lacewing was found mid season.

This field was closely monitored in 2002 and 2003 by taking imageries and aerial pictures using an Airborne Imaging Spectrometer for Application (AISA) with ground data collection (Figure 2). AISA mounted in a Cessna 172 three-passenger airplane was used to scan the surface. Spatial resolutions of the image collected over the research site ranged from 1x1 to 3x3 m and there were 50 bands ranging from 509 nm to 886 nm. Yield data were obtained from this field by providing a combine and support technician to the producer (Figure 3). Wheat was harvested using a John Deere 9500 combine and a GreenStar mapping system. Sorghum has not been harvested at the time this report is being written.

Table 2: Density dynamics of pests, predators, and weeds throughout the growing season in the Deaf Smith County wheat field in 2002 and 2003.

Sampling dates	Growth stages	Greenbugs		Corn leaf aphids		Birdcherry-oat aphids		Russian wheat aphids		Rice root aphids		Nabids		Spiders		Armyworms		Hippodamia convergens		Coccinella semptempunctata		Brown wheat mites		Field bindweeds	
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01.13.03	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
02.10.03	29	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
03.10.03	29	6	17	.	.	1	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
03.24.03	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
04.11.03	32	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	10	19
04.24.03	50	4	7	.	.	3	6	.	.	.	.	.	.	4	49	.	.	20	1	.	.	.	.	10	21
05.13.03	78	3	10	.	.	.	.	6	19	8	8	14	141	11	87	9	59	6	20	3	4	5	5	10	14
05.29.03	91	.	.	.	.	.	.	46	715	.	.	4	20	3	31	10	88	1	10	.	.	.	.	10	30
06.17.03	93	.	.	.	.	.	.	.	.	.	.	1	2	2	13	1	6	1	4	.	.	.	.	.	.
06.30.03		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	14

M - Maximum number of individual insects, mites, and weeds at one of the sampling points.
T - Total number of individual insects, mites, and weeds for the entire field.
. – Species were not found.

Table 3: Density dynamics of pests, predators, and weeds throughout the growing season in Deaf Smith County sorghum field in 2003.

Sampling Dates	Growth stages	Corn leaf aphids		Greenbugs		Nabids		Spiders		Hippodamia convergens		Coccinella semptempunctata		Coccinella larvae		Scymnus loweii		Green lacewings		Brown lacewings		Lacewing larvae		Orius		Fall armyworms		Johnsongrasses		Field bindweeds		Pigweeds	
		M	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**	**M**	**T**
07.15.03	2	16	16	.	.	3	15	1	1	4	4	.	.	.	.	1	1	.	.	.	.	.	.	19	71	.	.	.	.	.	.	.	.
07.22.03	2	142	376	.	.	2	6	1	1	8	25	.	.	.	.	1	1	.	.	.	.	.	.	10	29	.	.	.	.	.	.	.	.
07.28.03	3	675	2337	.	.	1	1	.	.	4	16	.	.	.	.	2	2	.	.	.	.	.	.	33	61	.	.	.	.	.	.	.	.
08.06.03	4	415	1996	.	.	2	3	1	1	4	19	1	1	2	3	.	.	.	.	.	.	.	.	5	19	.	.	.	.	.	.	.	.
08.13.03	4	260	1533	.	.	3	9	1	1	8	42	.	.	1	1	3	6	2	2	1	1	1	1	1	1	.	.	10	15	.	.	1	1
08.18.03	5	67	320	.	.	1	1	1	1	5	16	.	.	1	1	.	.	1	1	.	.	.	.	1	1	.	.	10	33	.	.	.	.
08.25.03	5	42	139	1	1	1	2	.	.	6	27	.	.	1	1	.	.	5	8	.	.	.	.	1	1	.	.	10	34	.	.	.	.
09.03.03	6	182	502	4	10	1	1	.	.	4	18	.	.	1	1	1	1	4	15	.	.	1	1	.	.	.	.	10	33	.	.	10	12
09.10.03	6	47	165	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	1	.	.	.	.	10	37	.	.	10	11
09.17.03	6	105	268	.	.	.	.	.	.	2	3	.	.	.	.	.	.	1	1	.	.	1	1	.	.	.	.	10	26	.	.	3	5
09.24.03	7	120	298	.	.	.	.	.	.	2	3	.	.	.	.	1	1	5	7	.	.	1	1	.	.	1	3	10	23	10	10	10	11
10.01.03	7	173	483	.	.	.	.	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	10	27	.	.	1	1
10.07.03	8	120	458	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	10	50	.	.	10	14
10.14.03	8	46	277	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	10	50	.	.	.	.
10.20.03	9	117	293	.	.	.	.	.	.	2	2	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	10	37	.	.	.	.
10.27.03	9	150	296	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	46	.	.	.	.
11.03.03	9	105	436	64	77	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	40	.	.	.	.
11.11.03	9	127	379	14	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	1	1	.	.	.	.	.	.	.	.

M - Maximum number of individual insects, mites, and weeds at one of the sampling points.
T - Total number of individual insects, mites, and weeds for the entire field.
. – Species were not found.

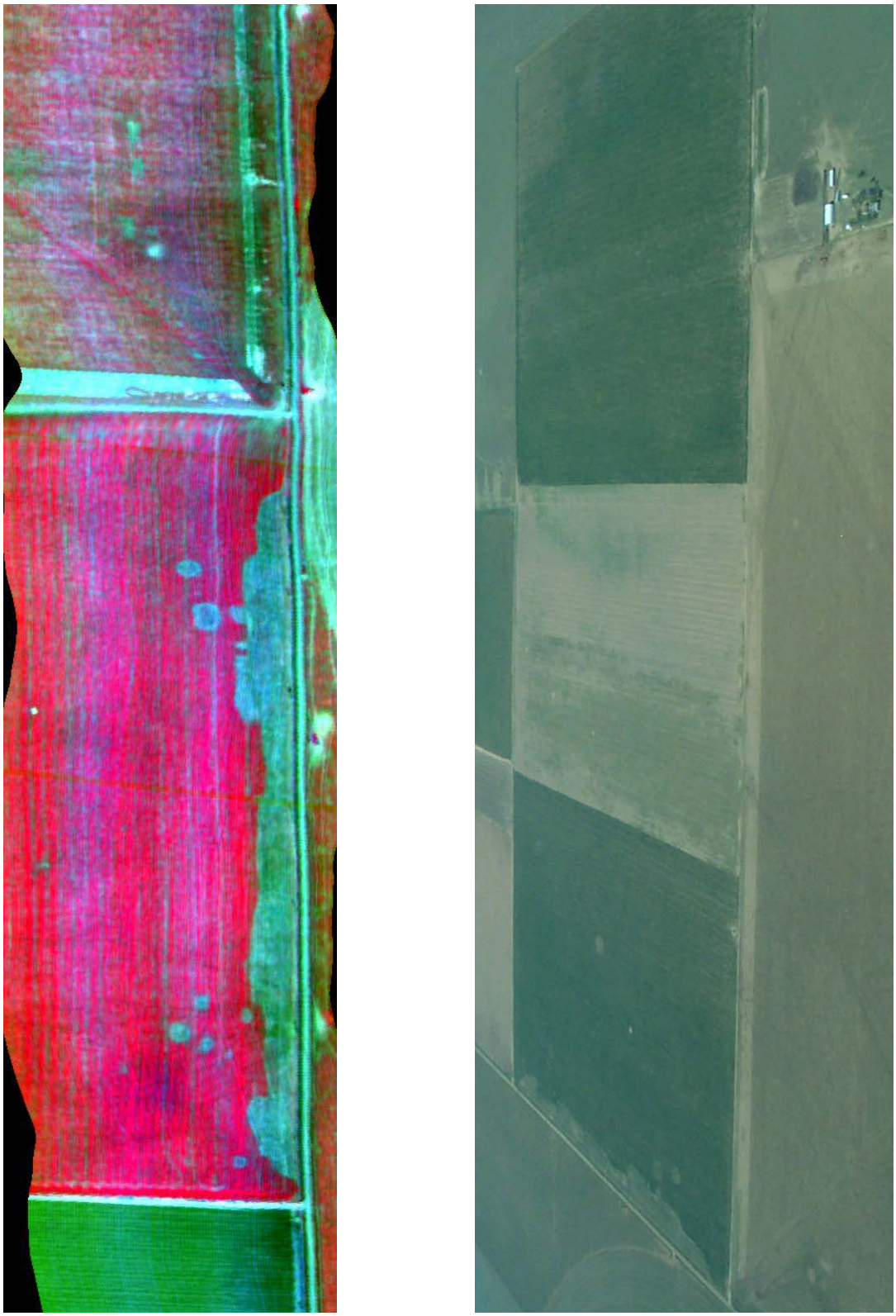


Figure 2: False color composite image (left) and aerial picture (right) of the Deaf Smith County wheat field.

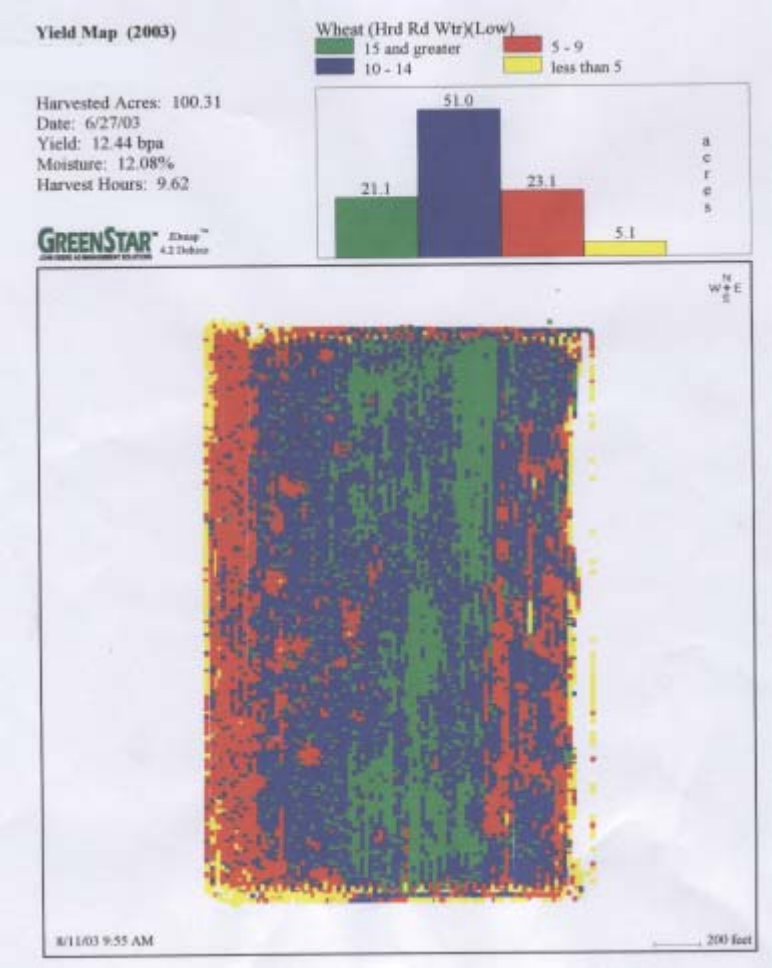
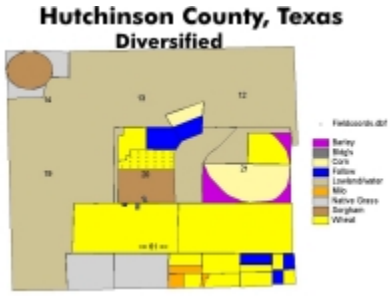


Figure 3: Yield map of the Deaf Smith County wheat field.

Hutchinson County Wheat and Sorghum Fields



Hutchinson County is located in north-central portion of the Texas Panhandle. It covers an area of about 583,040 acres or 911 square miles. The city of Stinnett is the county seat and Borger is the largest city in the county. About 74 percent of the Hutchinson County is used for range. Wheat is the main crop in Hutchinson County. The average annual rainfall is about 20.7 inches, and the average annual temperature is 58°F. The elevation above the sea level ranges from 2,750 to 3,400 feet. The soil series in AWPM field in Hutchinson County are Sherm (ShA) and Sunray (SuB) series.

The point coordinates of the southwest corner of the AWPM fields are -101.595 (longitude) and 35.967 (latitude) with an elevation of about 3,227.4 feet. This field, total area of 282.3 acres, was divided into two adjacent areas In 2002, winter wheat was planted in 109 acres and sampled during that growing season. Eighty nine bags of TAM 110 wheat seeds were delivered to the cooperator prior to the wheat planting in 2002. In the summer of 2003, sorghum was sampled in 173.4 acres. Sorghum fields were sampled weekly beginning in mid-July. However, aphid and beneficial insect population begin to decline in late August, 2003 in sorghum field. Thereafter counts were taken in the sorghum field biweekly. Yield data for both sorghum and wheat were obtained from the producer (Figure 4 and 5). A John Deere 9500 combine and a GreenStar mapping unit were used for harvesting and yield mapping, respectively.

Crested wheatgrass, Johnsongrass, and brome were found at the field borders. Brome was the only species found in wheat field (Table 4). Sampling dates, growth stages, overall density dynamics of the species found in this field were presented in Table 4. Few greenbug and birdcherry oat aphid were found in early March and continued being found in the field until harvest. Russian wheat aphid first appeared in early May and reached the highest amount just before harvest. There were high numbers of nabids, spiders, armyworms, and convergent ladybeetles during the late growing season. Mummies, carabids, *Scymnus loweii*, seven-spotted ladybeetles, green lacewings, and brown wheat mites were found once. In mid May, there were some green lacewing larvae.

Volunteer wheat, pigweed, crested wheatgrass, and Johnsongrass were found at the sorghum field borders. No weeds were found in the sorghum. The corn leaf aphid population fluctuated somewhat throughout the sorghum season. Density of corn leaf aphid was the highest on July 20. Aphid's natural enemies were high in late July and the first week of August. Green lacewings were found during the entire season.

Table 4: Density dynamics of pests, predators, and weeds throughout the growing season in the Hutchinson County wheat field in 2002 and 2003.

Sampling dates	Growth stages	Greenbugs		Birdcherry oat aphids		Russian wheat aphids		Nabids		Spiders		Hippodamia convergens		Coccinella semptempunctata		Coccinella maculata		Coccinellid larvae		Green lacewings		Lacewing larvae		Scymnus loweii		Black mummies		Armyworms		Carabids		Brown wheat mites		Bromus spp	
		M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T
11.07.02	24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11.19.02	24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12.03.02	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12.12.02	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
01.27.03	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	13
02.12.03	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	20
03.07.03	34	2	4	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	31
04.01.03	38	11	64	11	69	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	10	13
04.16.03	40	2	5	1	1	.	.	.	.	.	.	10	88	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	47
05.07.03	68	1	15	1	1	5	23	5	33	21	213	10	186	1	2	3	15	2	24	1	1	3	10	3	9	.	.	3	21	1	1	25	567	10	20
05.23.03	85	1	3	.	.	1	2	8	73	5	31	10	74	.	.	.	.	.	.	.	.	19	19	.	.	.	.	3	23	.	.	.	.	10	16
06.09.03	92	.	.	.	.	27	269	1	1	2	12	1	3	.	.	1	1	.	.	.	.	.	.	.	.	.	.	3	26	.	.	.	.	4	4

M - Maximum number of individual insects, mites, and weeds at one of the sampling points.

T - Total number of individual insects, mites, and weeds for the entire field.

. – Species were not found.

Table 5: Density dynamics of pests and predators throughout the growing season in Hutchinson County sorghum field in 2003.

Sampling dates	Growth stages	Corn leaf aphids		Nabids		Spiders		Hippodamia convergens		Coccinella semptempunctata		Coccinella maculata		Coccinellid larvae		Green lacewings		Brown lacewings		Lacewing larvae		Scymnus loweii		Orius	
		M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T
07.16.03	3	550	1379	6	13	1	2	18	80	4	5	3	9	7	10	1	2	1	1	2	3	2	5	2	7
07.21.03	4	565	2363	3	9	3	10	21	105	1	2	2	9	21	25	13	22	5	7	3	6	3	12	4	5
07.29.03	5	318	923	5	9	2	4	20	83	1	2	2	4	2	3	5	13	1	1	1	1	3	7	1	3
08.05.03	6	9	9	1	1	1	2	9	14	1	1	2	2	2	3	1	3	2	4	.	.	1	1	4	10
08.12.03	7	40	70	.	.	3	5	2	2	.	.	.	.	.	.	9	12	1	1	.	.	1	1	.	.
08.18.03	7	200	200	1	1	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	1	1	2	1	1
08.25.03	8	12	12	.	.	1	1	.	.	.	.	.	.	.	.	2	5	.	.	.	.	.	.	.	.
09.10.03	8	1	1	.	.	.	.	2	2	.	.	.	.	.	.	3	6	.	.	.	.	.	.	.	.
09.29.03	9	350	515	.	.	1	1	1	2	.	.	.	.	.	.	2	3	.	.	1	1	.	.	1	1

M - Maximum number of individual insects, mites, and weeds at one of the sampling points.
T - Total number of individual insects, mites, and weeds for the entire field.
. – Species were not found.

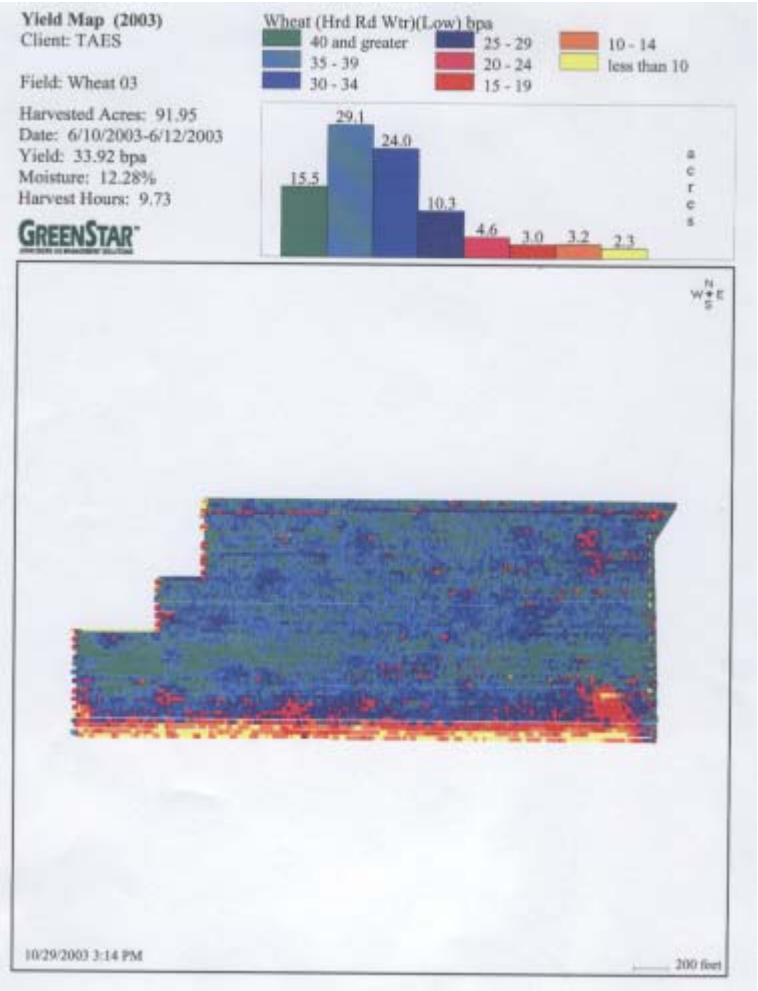


Figure 4: Yield map of the Hutchinson County wheat field.

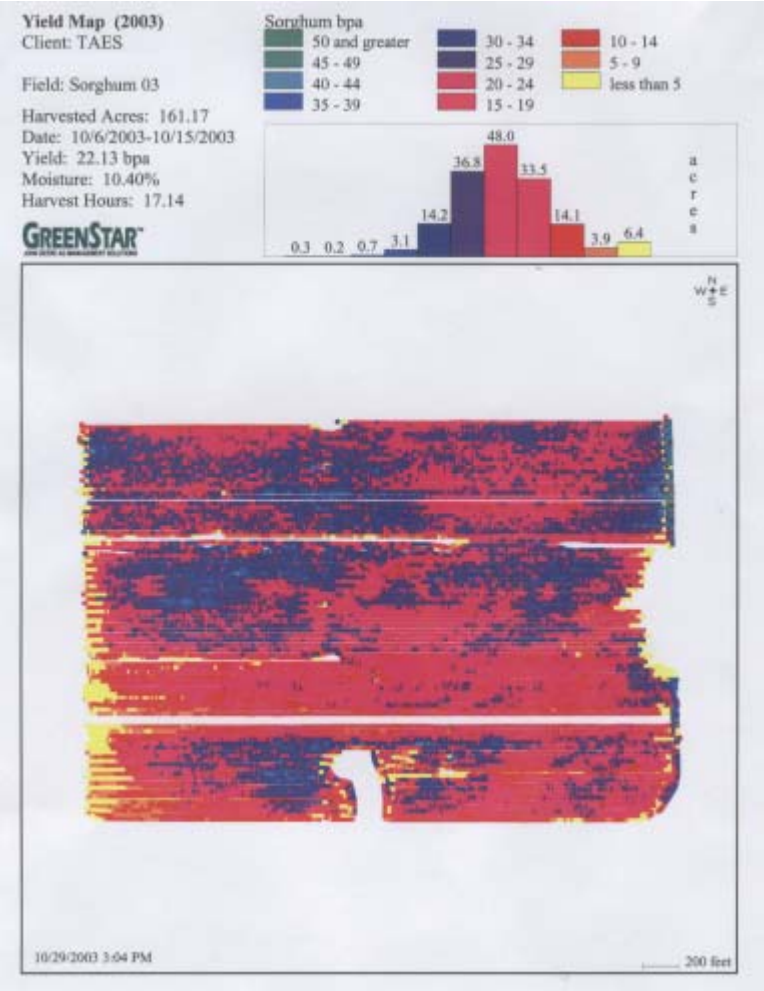
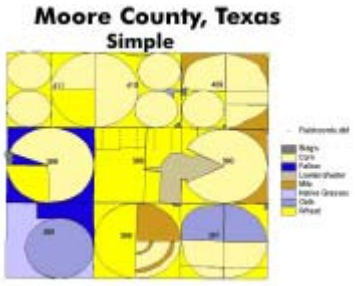


Figure 5: Yield map of the Hutchinson County sorghum field.

Moore County Wheat Field



Moore County is situated in north-central part of the Texas Panhandle (Figure). It covers an area of about 584,960 acres or 914 square miles. About 42 percent of the Moore County is used for crop production. The major crops are wheat and grain sorghum, lesser acreages of soybean, silage, corn and vegetable. Dumas is the largest city and county seat. Moore County has a dry, steppe climate. The average annual temperature is about 57.5°F. The average annual rainfall is 18.95 inches but varies from 8 to 27 inches. There are periods of drought in which dry-farmed crops produce little followed by years that are wet enough to produce profitable crops. The soil series in the AWPM field are Sherm (ShA) and Conlen (CoB) series.

The point coordinates of the northwest corner of the AWPM fields are -102.068 (longitude) and 35.967 (latitude) with an elevation of about 3,629.3 feet. In 2002, winter wheat was planted in the field and 189.6 acres was sampled (Figure). One hundred and nine bags of TAM 110 wheat seeds for the 189.6 acres were delivered to the owner of this field prior to the wheat planting in 2002. This field was grazed by cattle about one and a half months during the late winter and early spring in 2003. Yield data were obtained from this field by providing a combine and support technician to the grower (Figure 6). Wheat was harvest using a John Deere 9550 STS combine and a GreenStar mapping unit.

Weed species found at the field borders were Johnsongrass, brome, crested wheatgrass, and jointed goatgrass. Pigweed, barnyardgrass, and field bindweed were found in wheat field (Table 6).

Table 6 contains sampling dates, growth stages, and overall information about pests and their natural enemies. Like the Hutchinson County wheat field, few greenbug, birdcherry-oat aphid, and Russian wheat aphid were found during the entire season. Nabids, spiders, convergent ladybeetles, and armyworms were found starting from late April to harvest. English grain aphids, *C. maculata*, green lacewings, and brown lacewings were found in low numbers.

Table 6: Density dynamics of pests, predators, and weeds throughout the growing season in the Moore County wheat field in 2002 and 2003.

Sampling dates	Growth stages	Greenbugs		Birdcherry-oat aphids		Russian wheat aphids		English grain aphids		Nabids		Spiders		Hippodamia convergens		Coccinella maculata		Coccinellid larvae		Green lacewings		Brown lacewings		Lacewing larvae		Armyworms		Field bindweeds		Amaranthus spp		Barnyardgrasses	
		M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T
11.05.02	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	616	1	10	10	46
11.14.02	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	553	.	.	.	.
11.18.02	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	222	.	.	.	.
12.11.02	28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
01.27.03	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
03.12.03	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
03.26.03	33	2	9	3	5	.	.	.	.	.	.	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	184	.	.	.	.
04.15.03	35	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	574	.	.	.	.
04.30.03	65	2	4	2	11	2	6	1	3	2	6	13	163	2	17	1	2	3	10	1	2	1	1	1	1	1	1	10	540	.	.	.	.
05.20.03	83	2	9	.	.	2	13	.	.	3	10	6	55	1	1	.	.	.	.	.	.	.	.	.	.	4	23	10	591	.	.	.	.
06.02.03	91	.	.	.	.	12	10	.	.	2	11	5	60	1	2	.	.	.	.	.	.	.	.	.	.	12	136	10	575	.	.	.	.
06.18.03	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	628	10	173	.	.

M - Maximum number of individual insects, mites, and weeds at one of the sampling points.

T - Total number of individual insects, mites, and weeds for the entire field.

. – Species were not found.

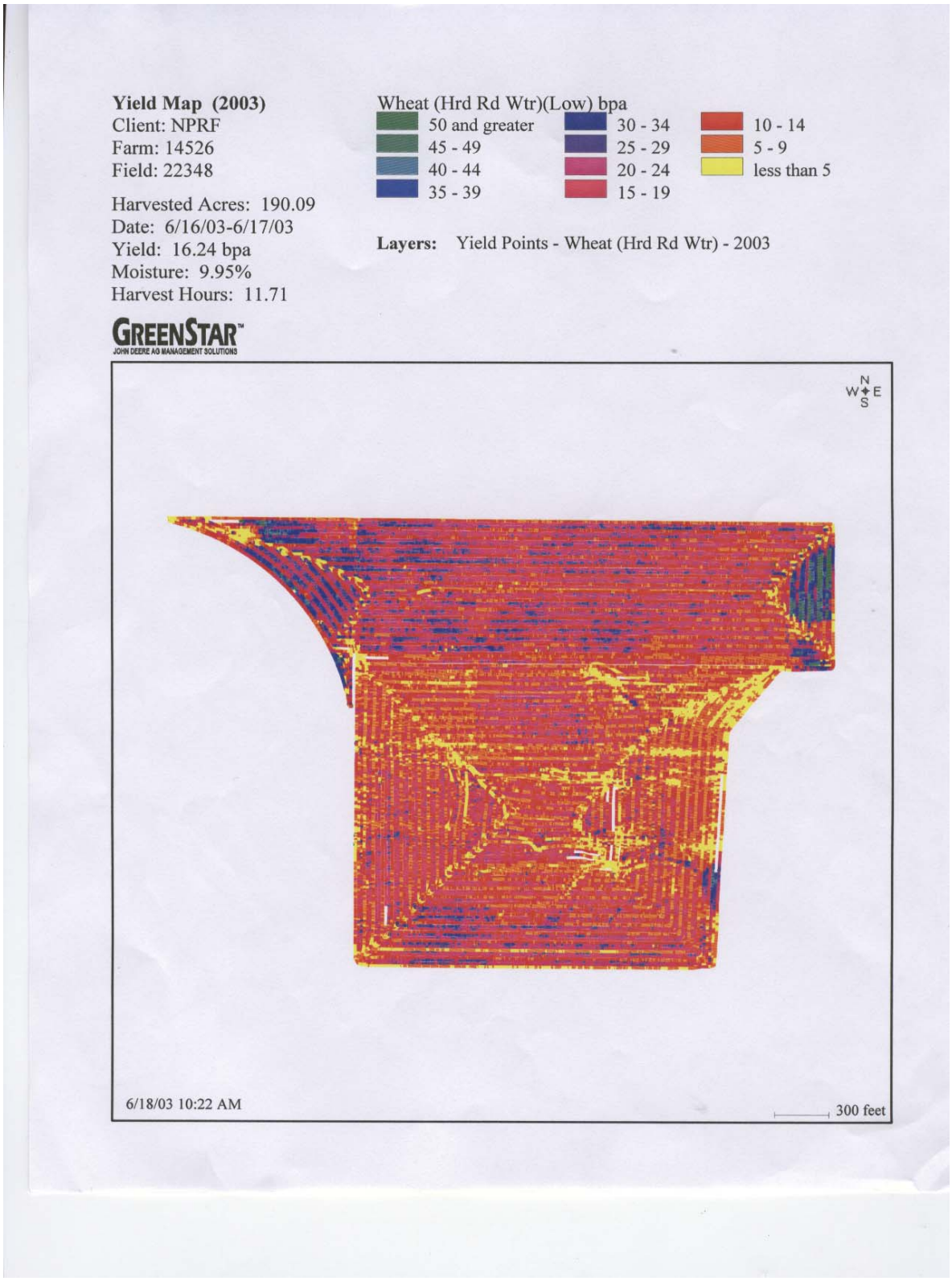
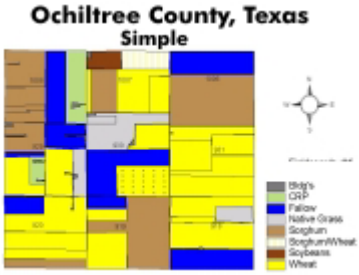


Figure 6: Yield map of the Moore County wheat field.

Ochiltree County Wheat Field



Ochiltree County is in the northwestern part of Texas, at the northern edge of the Texas Panhandle (Figure) . The county is about 30 miles square and has a total area of about 580,480 acres or about 907 square miles with an average elevation 2930 feet. Perryton is the county seat. About 70 percent of the county is cropland and the remaining 30 percent is rangeland. Most of the cultivated acreage is dryland. The major crops in this county are wheat and grain sorghum.

The climate of the county is sub-humid. The average annual rainfall is about 21.13 inches and the average annual temperature is about 57°F. The soil series in AWPM field in Ochiltree County are the Pullman (PmA and PmB), and Randall (Ra) series. The point coordinates of the southeast corner of the AWPM fields are -100.693 (longitude) and 36.348 (latitude) with an elevation of about 2,791.7 feet. This field, total area of 515 acres, was divided into four adjacent areas, two of which are subject to wheat – fallow - wheat rotation each year. Parts of the field are 152, 173, 100, and 90 acres, respectively. In 2002 and 2003, 152 acres of the field was sampled. One hundred seventy three acres are being sampled in the fall of 2003. This field is not subject to grazing by cattle. The cooperators harvested this field without notifying us and therefore no yield data were obtained.

Field bindweed and brome were found in the field (Table 7). Brome, crested wheatgrass, jointed goatgrass, and Johnsongrass were found at the field borders.

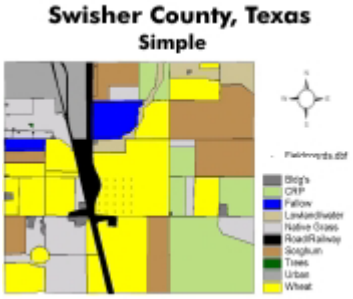
Sampling dates, growth stages, population dynamics of species found in this were given in Table 7. Greenbug and birdcherry oat aphid were found for the first time in late February, 2003, and stayed in the field during the rest of the season. There were high numbers of Russian wheat aphids, nabids, spiders, and convergent ladybeetles from late April to harvest. Seven-spotted ladybeetles, green lacewings, brown lacewings, *Scymnus loweii*, mummies, armyworms, carabids, and brown wheat mites were rarely found in this field.

Table 7: Density dynamics of pests, predators, and weeds throughout the growing season in the Ochiltree County wheat field in 2002 and 2003.

Sampling dates	Growth stages	Greenbugs		Birdherry oat aphids		Russian wheat aphids		Nabids		Spiders		Hippodamia convergens		Coccinella semptempunctata		Coccinellid larvae		Green lacewings		Brown lacewings		Scymnus loweii		Black mummies		Armyworms		Carabids		Brown wheat mites		Amaranthus spp		Bromus spp	
		M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T
11.08.02	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11.20.02	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12.04.02	28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12.16.02	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2
01.28.03	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3
02.21.03	30	2	3	7	7	.	.	.	.	.	.			.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	1	3
03.13.03	30	.	.	1	1	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3
04.07.03	32	14	61	17	126	.	.	.	.	.	.	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4
04.17.03	32	1	2	3	8	.	.	.	.	.	.	5	11	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	1	1
05.12.03	75	1	7	4	11	2	3	4	12	8	58	6	39	1	1	1	1	.	.	1	1	1	1	.	.	.	.	1	3	4	9	.	.	1	1
05.28.03	87	1	1	1	1	2	12	6	56	7	63	7	58	.	.	.	.	2	9	.	.	.	.	.	.	4	33	.	.	.	.	.	.	.	.
06.12.03	92	.	.	17	78	54	386	6	26	3	23	7	35	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
07.01.03		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	13	.	.

M - Maximum number of individual insects, mites, and weeds at one of the sampling points.
T - Total number of individual insects, mites, and weeds for the entire field.
. – Species were not found.

Swisher County Wheat Field



Swisher County is in the south central part of the Texas Panhandle (Figure). The county has a total area of 573,440 acres or about 896 square miles. Tulia is the county seat. This county is a nearly level, playa-pocked, short-grass prairie. Elevation ranges from about 3,250 feet in the eastern part to 3,700 feet in the northwestern part. The climate of Swisher County is dry steppe. The average annual rainfall is about 17.24 inches and the average annual temperature is about 59.1°F.

Development of the county has depended on farming. About 80 percent of the county's land area is cultivated, and most of this is irrigated. The major crops are grain sorghum, wheat, cotton, and soybean. About 20 percent of the county is in native range that is grazed by cattle. The soil series in AWPM field in Swisher County are Pullman (PmA) series.

The point coordinates of the southwest corner of the AWPM fields are -101.838 (longitude) and 34.721 (latitude) with an elevation of about 3,506.9 feet. This field is 541 acres. Data for AWPM project were collected in 161.8 acres of the field. This field was grazed year round by cattle during the wheat-growing season in 2002 and 2003. The southwest corner of the field where sampling grids and points were located was grazed heavily in the spring of 2003. Therefore, no wheat was left to sample at 20 of the 25 sampling points. Data are being collected in this field for 2003 and 2004. Like the field in Deaf Smith County, this field was also closely monitored in 2002 and 2003 (Figure 7).

Common weed species found in this field were field bindweed and brome (Table 8). At the field borders, Johnsongarss, crested wheatgrass, brome, and jointed goatgrass were found.

Sampling dates, growth stages, population dynamics of species found in this field were given in Table 8. Greenbug and birdcherry-oat aphid were found in March, 2003, and they disappeared shortly. Thereafter some Russian wheat aphids were found in May. Nabids, spiders, mummies, and armyworms rarely occurred in this field. Convergent ladybeetles were found from late April to harvest.

Table 8: Density dynamics of pests, predators, and weeds throughout the growing season in the Swisher County wheat field in 2002 and 2003.

Sampling dates	Growth stages	Greenbugs		Birdcherry oat aphids		Russian wheat aphids		Corn leaf aphids		Nabids		Spiders		Hippodamia convergens		Coccinellid larvae		Mummies		Armyworm		Bromus spp		Field bindweeds		Amaranthus spp	
		M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M	T
11.04.02	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	10	279	3	5
11.18.02	25	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	3	6	10	181	.	.
12.02.02	26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	13	10	126	.	.
12.17.02	28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	8	10	59	.	.
01.22.03	29	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	19	.	.	.	.
03.11.03	29	1	3	10	38	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	19	3	3	3	3
03.27.03	30	45	334	21	171	.	.	.	.	.	.	.	.	6	15	3	3	6	16	.	.	3	28	10	95	.	.
04.14.03	33	.	.	.	.	.	.	.	.	.	.	.	.	7	45	.	.	.	.	.	.	3	13	10	191	.	.
04.28.03	65	1	2	2	6	.	.	.	.	12	40	6	18	5	14	.	.	.	.	.	.	1	2	10	16	.	.
05.14.03	85	.	.	.	.	1	1	.	.	2	3	1	1	1	1	.	.	.	.	1	1	.	.	3	18	.	.
05.30.02	93	.	.	.	.	13	41	.	.	.	.	.	.	1	1	.	.	.	.	2	5	.	.	10	46	.	.
06.17.03	95	.	.	.	.	.	.	.	.	1	2	2	4	.	.	.	.	.	.	.	.	.	.	10	80	.	.
06.25.03		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	203

M - Maximum number of individual insects, mites, and weeds at one of the sampling points.
T - Total number of individual insects, mites, and weeds for the entire field.
. – Species were not found.

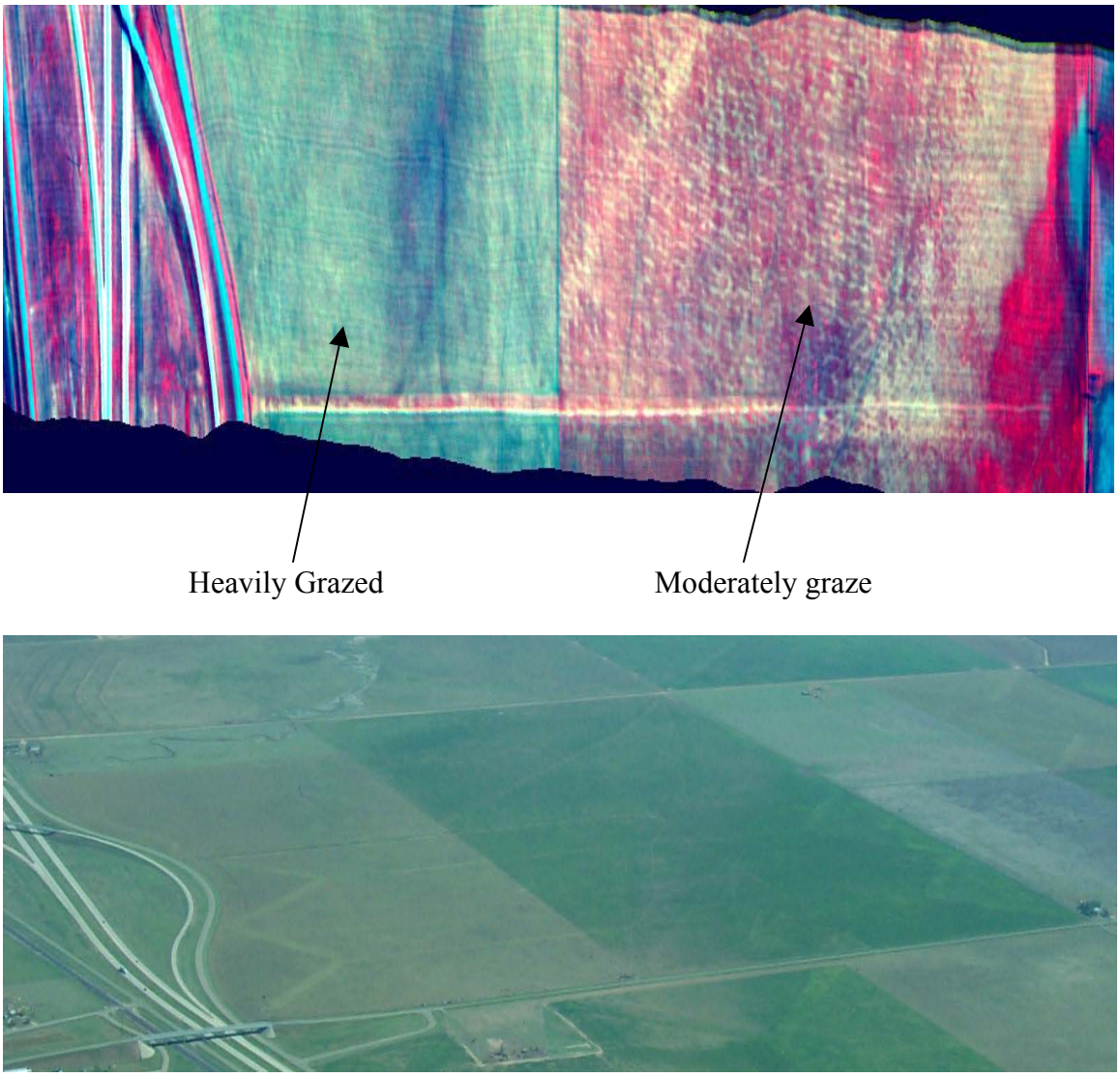
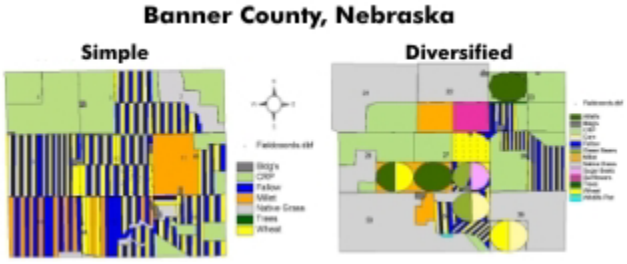


Figure 7: False color composite image (top) and aerial picture of the Swisher County wheat field.

c. Nebraska/Wyoming Demonstration Sites

Phase II, Year 1 (2002-2003)
Prepared by Gary Hein, Drew Lyon, John Thomas, and Rob Higgins

Nebraska Sites



The paired locations of sites in Nebraska were located in western Banner County. The areas surrounding both fields have a large amount of rangeland grass or CRP grassland. Sampling of these locations began in the fall of 2002 and continued until the end of the season in 2003. Overall the aphid populations were low until late in the season.

Diversified rotation: The grower of the diversified-rotation field shown at left suffered very serious drought losses in 2002, averaging less than 5 bushels of wheat per acre on his whole operation. His targeted rotation is winter wheat / sunflowers / proso millet / spring crop. The spring crop is still the unknown in his rotation as he has not arrived at a good option for his system. He would like to include barley but because of potential Russian wheat aphid problems he has not consistently adopted this. A resistant barley variety would fit into his system well as he raises cattle and could use the barely for feed. His second option for this fourth year is a second year of proso millet. This option got him into trouble in 2002 as his millet was severely drought stressed until late in the season when it began to grow and mature very late. He was not able to get his millet off until well into October, and he did not plant his wheat until October 10-11. This is a full month after the recommended planting date for the area. The wheat was just barely through the ground when it went dormant with the cool weather. In the spring the wheat did resume growth but through the winter there had been a tremendous infestation of kangaroo rats that had moved into the field and destroyed a significant amount of wheat. Close to 10% of the wheat had been torn up or consumed by these rodents.

The wheat was growing well through the spring, but it was significantly delayed compared to the wheat in the surrounding areas. Because of the much delayed planting, no aphids were seen it the field until May 21 when a 7% infestation of RWA was observed. The infestation quickly increased to about 35% on June 5. Because this field had been planted to Halt, a RWA resistant variety, the extent of the infestation and the rapid buildup was very surprising. At this point we had heard that Colorado State had already identified the same problem in resistant varieties in Colorado. Therefore, we assumed that we also were seeing the presence of this new RWA biotype. Infestations increased until July 9 when 600 RWA per row foot were found in the Berlese samples. The seriousness of the infestation was largely due to the lateness of this wheat field because the surrounding fields planted to susceptible varieties that were all at more mature stages showed no significant sign of serious RWA infestation. Dry and

hot conditions during late June and early July had a negative effect on this field and the field averaged 18 bushels per acre (harvested July 22). Clearly, this yield had been impacted by late planting, rodents, RWA and late season drought.

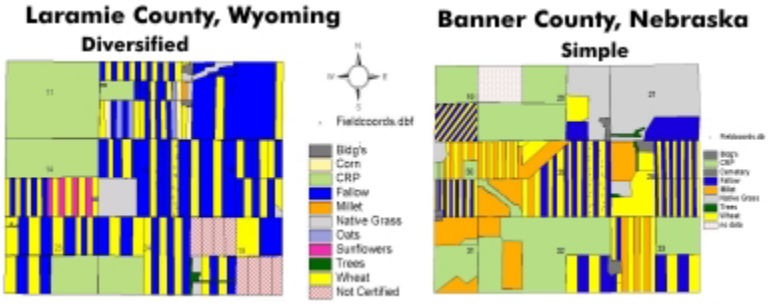
Greenbug populations in the field were first found on June 5 with only a 1% infestation level and 25 per row foot. Greenbug populations did not increase from this point. Because of the high aphid populations, coccinellid populations were very high in this field. Coccinellid populations began to increase on June 18 about a month after the aphids showed up and increased to a high of 14 adults and 14 larvae per 25 sweeps or 1.1 coccinellids per sweep.

Very few grass weeds were observed in the winter wheat field or the adjacent summer crop fields. In the spring there were a few broadleaf weeds in the winter wheat field, but these were controlled with herbicides. Insect pests were not a big problem in the alternate crops, but pheromone sampling for the sunflower head moth indicated a significant populations and the field was treated with insecticide. Control of the head moth was good, but later infestations may have resulted in a low-moderate infection rate of Rhizopus head rot in the sunflowers. No additional pest problems were noted in this rotational system.

Wheat / fallow rotation: The grower has farmed in the winter wheat / fallow system for many years. He planted his winter wheat just a little late due to area rains (Sept. 13). A good stand was obtained in the fall and the crop went into the winter in very nice shape with no aphid infestations. Sampling in the spring indicated only a slight RWA infestation of 1% infested tillers. This infestation did not increase through the spring as it remained 1% until heading when it dropped. This drop is likely due to the difficulties of locating aphids within the wheat heads. Berlese samples indicated that aphid populations did increase through the heading period until we saw about 42 aphids per row foot on July 2. This field was harvested on July 13 and yielded an average of 40 bushels per acre. The only significant impact on yield during the season appeared to be moderate to severe drought stress occurring during the late season period.

No other insect pest or disease problems occurred in the field. As was expected for such low aphid infestation, coccinellid populations were low as well peaking at only 6 adults and larvae per 25 sweeps on July 2 just before full maturity. Weeds were not a problem in the fall in the growing wheat. However, the adjacent fallow fields had moderate to heavy infestations of volunteer wheat prior to wheat planting. Light to moderate infestations of feral rye and downy brome developed in the winter wheat fields over the winter and into the spring. No significant disease impacts were seen in the wheat.

Wyoming/Nebraska Sites



The two sites for this pair are located in Wyoming and just across the border in Nebraska. Growing conditions for this pair of locations was much better than most of the surrounding region. These areas saw considerably more rainfall both just before planting and through the season. Planting at both locations was delayed by rainy and wet conditions, but wheat establishment was excellent at both locations.

Diversified Rotation: The diversified-rotation grower in 2002 suffered very serious drought losses and averaged less than 5 bushels wheat per acre on his whole operation. As a result of the extremely dry conditions in 2002, he did not plant sunflowers as he had anticipated. Beginning in early August the rains began and he saw over 10 inches of rainfall in the next 6 weeks (normal annual precipitation ca. 13 inches). He planted somewhat late for the area on Sept. 18-19, but due to the adequate moisture, establishment and stands were good. These fields were planted to the RWA resistant varieties Halt and Prowers. No RWA infestations were seen in these fields until May 30 when a 1% infestation levels was found. These aphid levels did not increase and very low coccinellid populations were seen as well (0.45 /25 sweeps).

Very few grass weeds were observed in the winter wheat field. In the spring there were a few broadleaf weeds in the winter wheat field, but these were controlled with herbicides. No additional pest problems were observed in these fields through the course of the season, but in June a significant hail damaged the crop. After re-growth from the hail damage, the wheat was harvested on August 4-6 and it yielded 27.5 bushels. This is a good yield considering the impact of the hail that was seen.

This grower again did not plant sunflowers in 2003 and has changed his ideas on his rotations because of the serious dry conditions he has seen the last years. Since wheat harvest, we have identified another diversified rotational grower in the area and have initiated our fall 2003 sampling on this growers land.

Wheat/fallow rotation: This location is surrounded by a good deal of perennial grass including some CRP in the area. The section where the fields are located is cut up by grassed waterway and drainage. The wheat/fallow grower was delayed slightly in planting in the fall of

2002 because of rain. However, more than adequate rainfall during this period resulted in very good establishment and stand of wheat after planting on Sept 3-4 (cv. Ogallala). RWA populations were not observed in the fall but a 1% infestation was observed on April 29. This aphid population did not increase over the spring and only reached a 3% infestation on June 26. The maximum density of RWA was seen on June 26 also at 100 RWA per row foot. Maximum coccinellid levels were seen on June 11 at 6/25 sweeps. Very low numbers of Greenbugs were also seen (<1% infestation).

Weeds were not a problem in the fall in the growing wheat. However, the adjacent fallow fields had moderate to heavy infestations of volunteer wheat prior to wheat planting. Light to moderate infestations of feral rye and downy brome developed in the winter wheat fields over the winter and into the spring. No significant disease impacts were seen in the wheat. The fields were harvested on July 20 and the wheat yielded 41.6 bushels per acre, a very good yield for this area.

d. Oklahoma Demonstration Sites

Phase II, Year 1 (2002-2003)
Prepared by Kris Giles and Vasile Catana

During the 2002-2003 winter wheat growing season in Oklahoma, a total of six demonstration sites were evaluated by OSU and USDA-ARS scientists for aphid, natural enemy, and weed abundance. A pair of diverse (wheat in rotation with another crop) and simple (continuous wheat) sites were identified in Jackson, Alfalfa, and Kay/Noble county (Fig. 1). Demonstration sites in these counties were chosen to represent the variability in environmental conditions that can occur within Zone-2 (continuous cropping) of the overall areawide program.

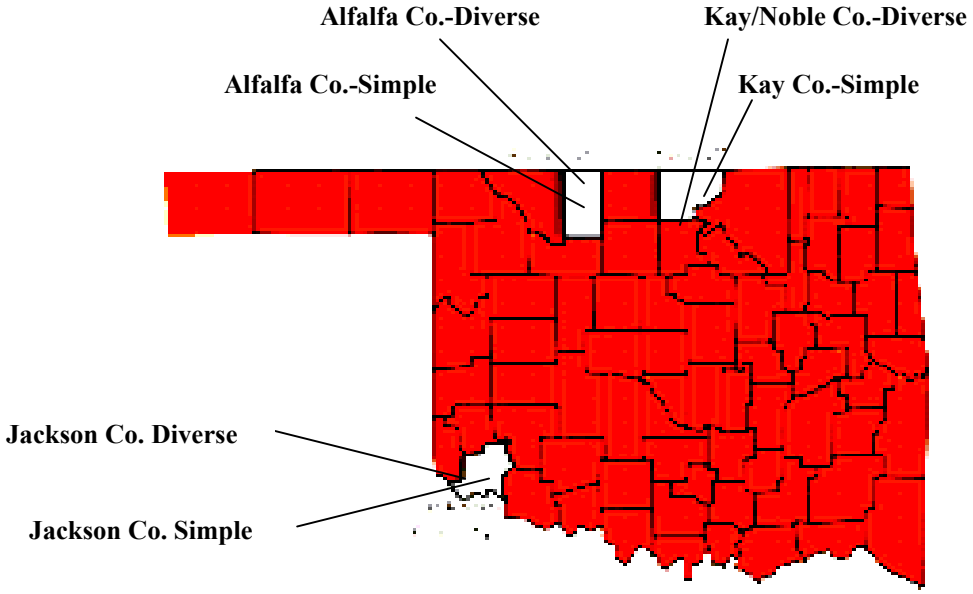


Figure 1. Location of demonstration sites in Oklahoma

Site Description

Jackson County. The diverse site was chosen primarily because the grower rotates winter wheat with a variety of different crops including alfalfa, sorghum, corn, peanuts, and cotton. Following the 2002-2003 winter wheat crop, cotton was rotated into production (Fig. 2 A). This field was embedded within a diverse landscape that included a significant area of lowland water. The simple (continuous wheat) site (Fig. 2 B) was embedded primarily within a grass habitat (Wheat and other grasses).

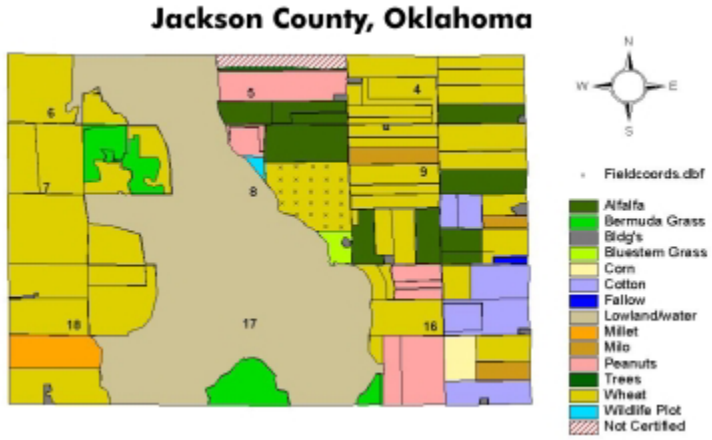


Fig. 2 A. Jackson Co. Diverse

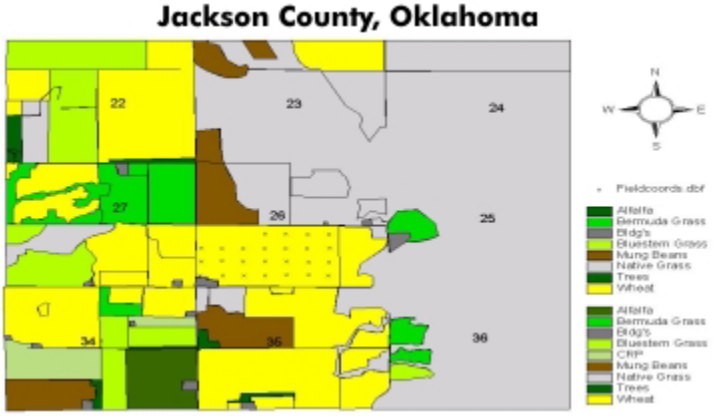


Fig. 2 B. Jackson Co. Simple

Alfalfa County. The diverse site was chosen primarily because the grower rotates winter wheat with sorghum. Following the 2002-2003 winter wheat crop, sorghum was rotated into production (Fig. 2 C). This field was embedded within a landscape mostly of wheat, but with a small amount of alfalfa and sorghum. The simple (continuous wheat) site (Fig. 2 D) was embedded primarily within a grass habitat (Wheat and other grasses) with a small amount of alfalfa production.

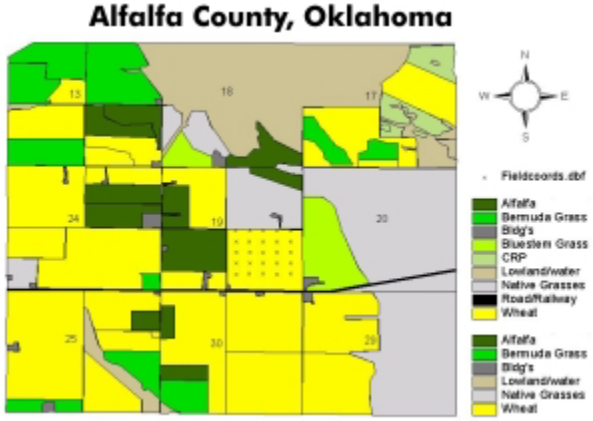


Fig. 2 C. Alfalfa Co. Diverse

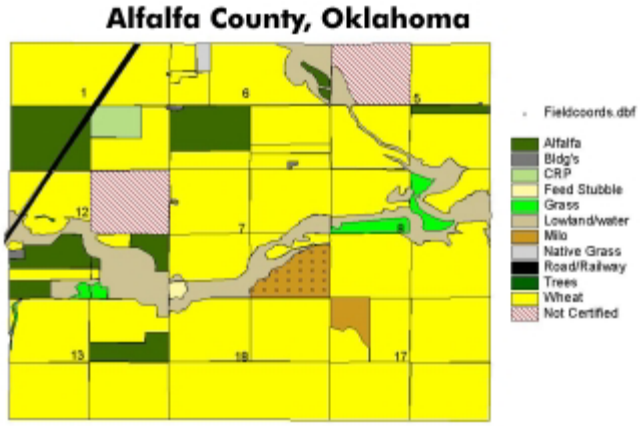


Fig. 2 D. Alfalfa Co. Simple

Kay/Noble Counties. The diverse site was chosen primarily because the grower rotates winter wheat with sorghum. Following the 2002-2003 winter wheat crop, sorghum was rotated into production (Fig. 2 E). This field was embedded within a landscape mostly of wheat, but with a significant area devoted to soybean production and small amount of alfalfa. The simple (continuous wheat) site (Fig. 2 F) was embedded primarily within a grass habitat (Wheat and other grasses) with a small amount of alfalfa production.

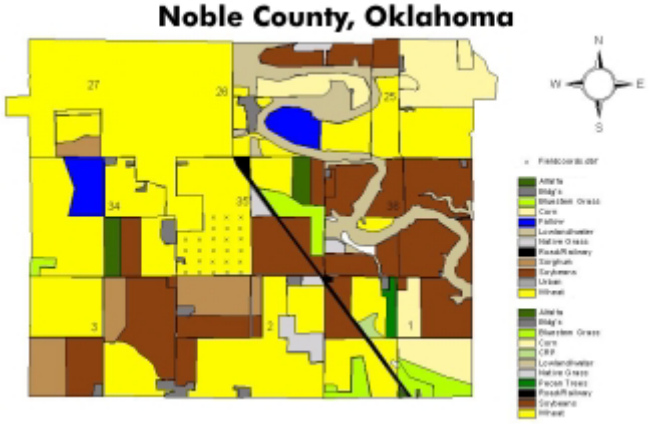


Fig. 2 E. Kay Co. Diverse

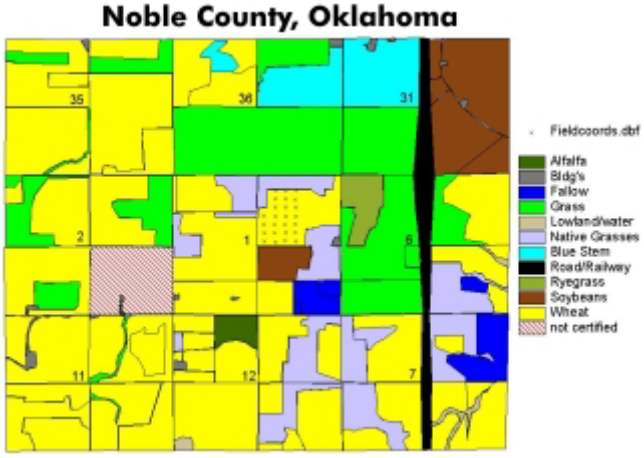


Fig. 2 F. Kay/Noble Co. Simple

Sampling

Developed protocols for sampling arthropods and weeds in wheat and alternative crops were followed (See appendix for details). Briefly for arthropods in wheat, we sampled for aphids (Tiller and Burlese), predators (Visual and Sweep), and parasitoids (Tiller / emergence tubes) at 25 grided locations throughout each field multiple times during the growing season.

Results

Arthropod abundance in wheat

Aphids and parasitoids from tiller samples. In general, greenbugs were found at extremely low levels in all of the fields evaluated (Fig. 3). Parasitism (*Lysiphlebus testaceipes*) of greenbugs at each site was consistently present throughout the growing season, which clearly limited numbers. Significant numbers of other aphids (primarily Bird-cherry-oat aphids - BCOA) were present at a few of the locations, but showed no noticeable trends between diverse and simple demonstration sites. BCOA did however supply significant hosts for parasitoids and predators.

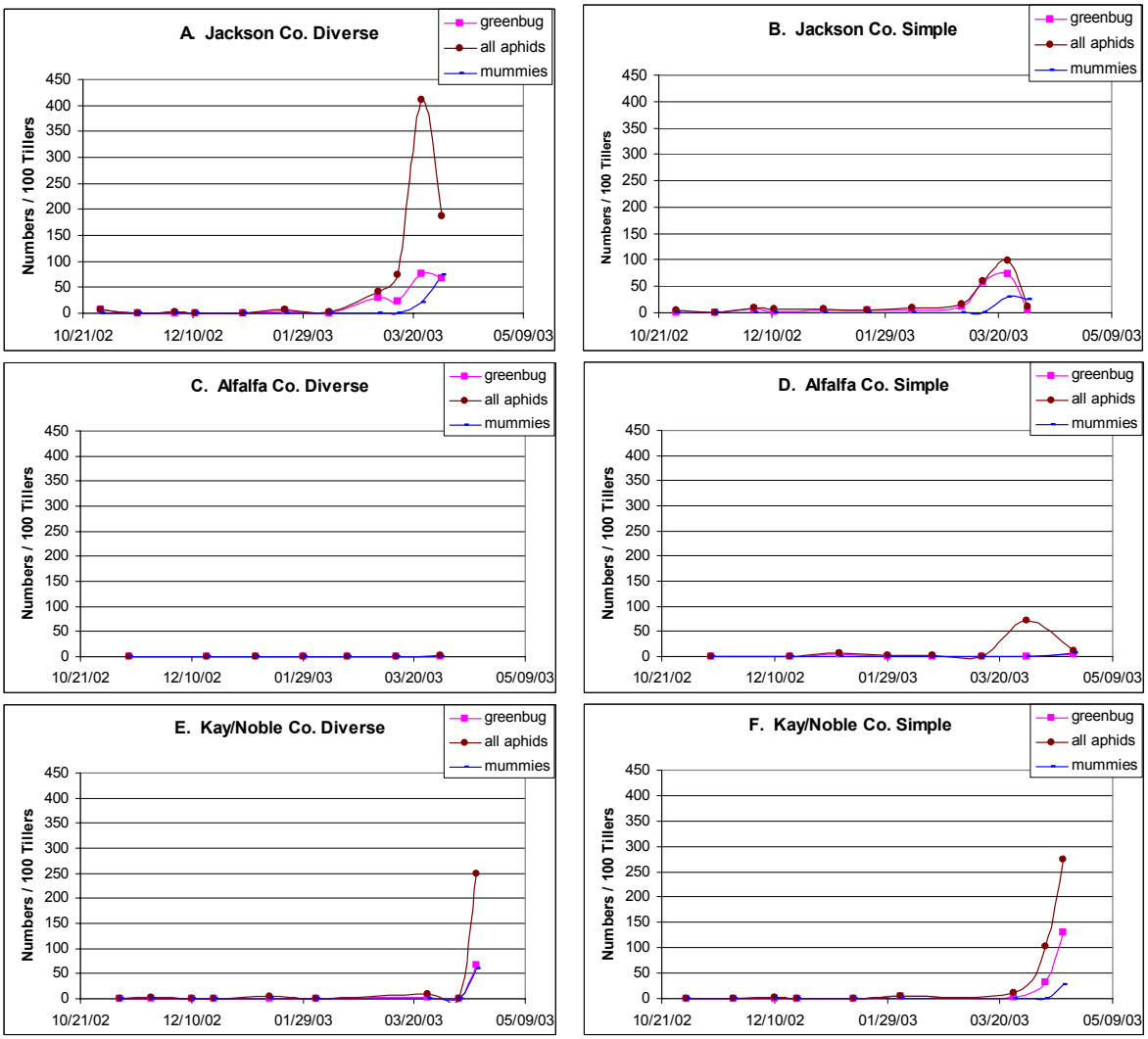


Figure 3. Greenbugs, all aphids combined, and mummies (parasitized aphids) in Winter Wheat at Oklahoma Demonstration Sites.

Aphids from burlese samples. Greenbugs were found at extremely low levels in all of the fields evaluated (Fig. 4). No noticeable trends in aphid abundance between diverse and simple demonstration sites were observed other than the consistently higher numbers at the beginning of the field season at diverse sites. When aphids were abundant, BCOA and Cornleaf-aphids were the primary aphids found. These aphids likely supplied significant hosts for parasitoids (Fig. 3) and predators (Figs. 5 and 6).

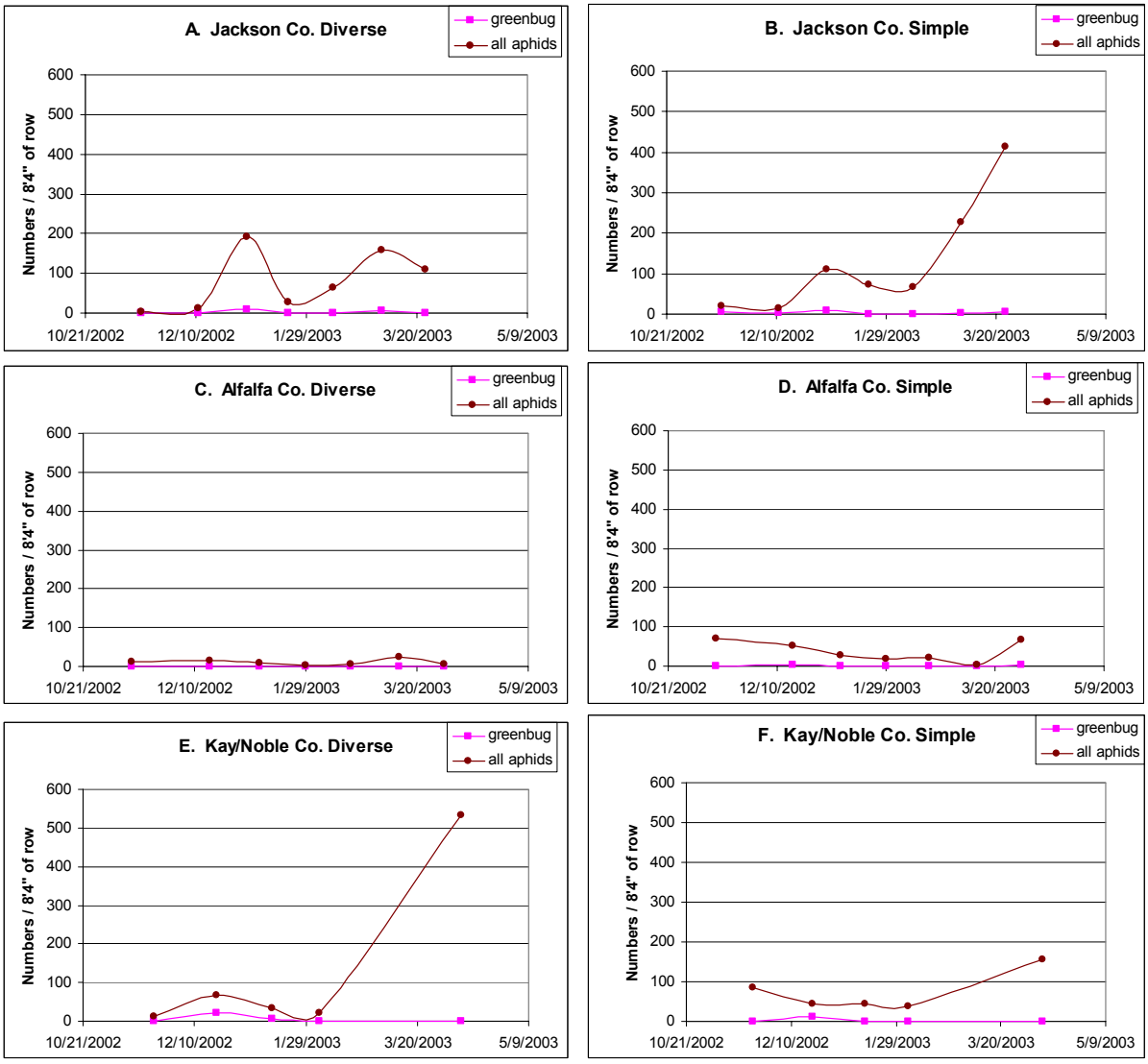


Figure 4. Greenbugs and all aphids in Burlese samples from Winter Wheat at Oklahoma Demonstration Sites. Numbers were summed over twenty five 4"- burlese samples.

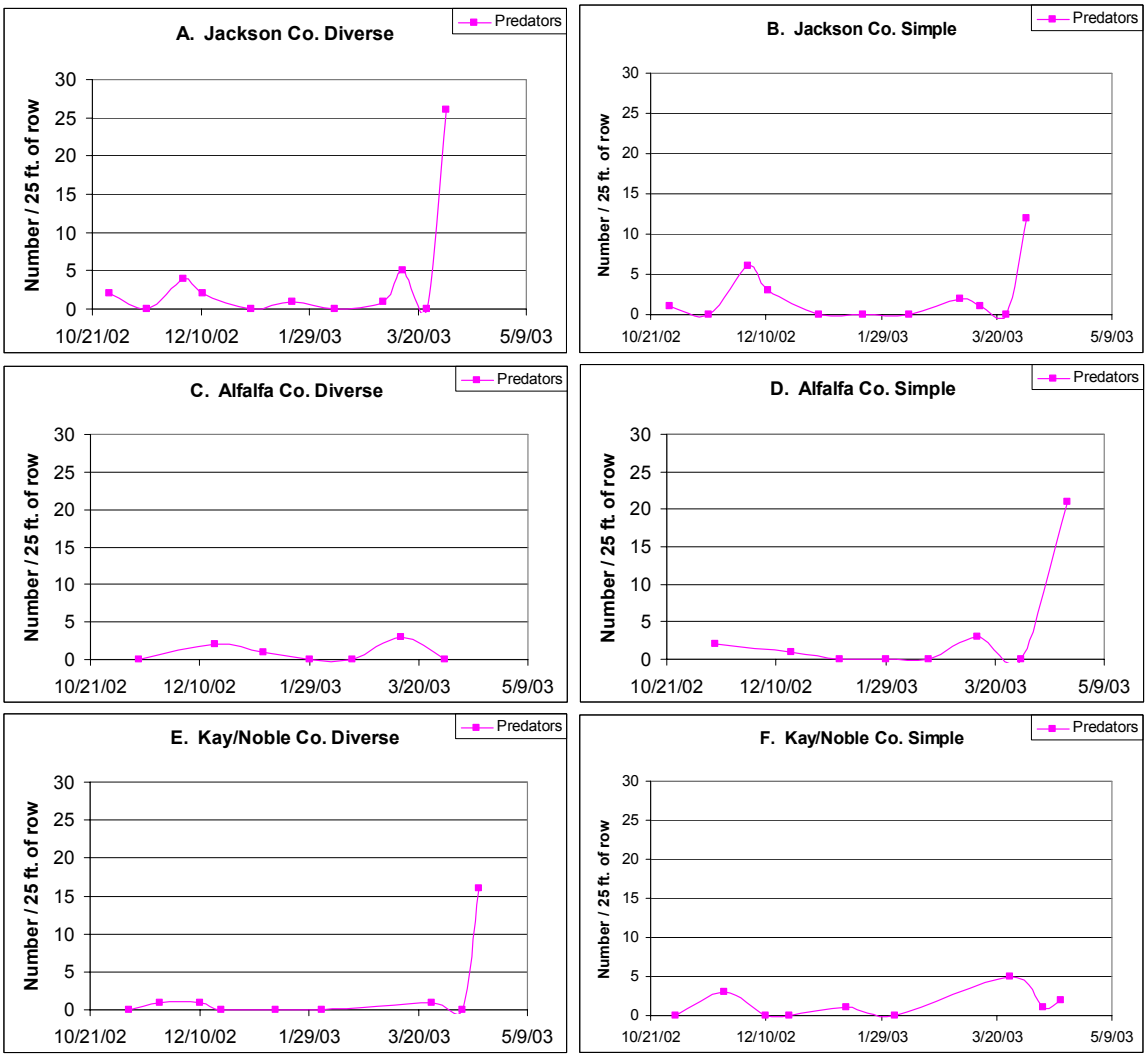


Figure 5. All arthropod predators in Winter Wheat at Oklahoma Demonstration Sites. Numbers were summed over twenty five 12"-visual samples.

Predators from visual and sweep samples. Predators in general were found at low levels in all of the fields evaluated (Figs. 5 and 6). Higher peak numbers of predators were found at diverse sites (vs. simple) at Jackson and Kay/Noble demonstration sites. At Alfalfa County, predator numbers were higher at the simple site; it is important to notice however that the landscape differences in Alfalfa County were minimal. Predator numbers appeared to be related to aphid numbers; when aphids were abundant, they likely supplied significant prey for predators.

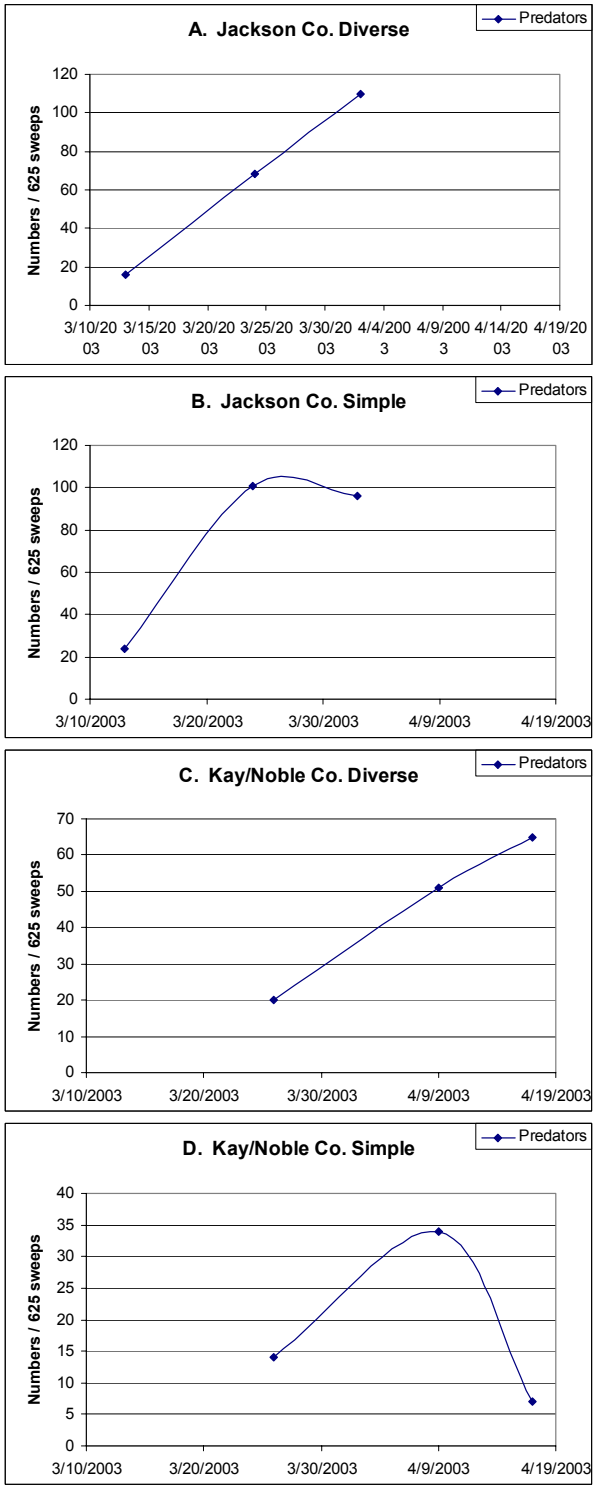


Figure 6. All arthropod predators in Sweep Samples in Winter Wheat at Oklahoma Demonstration Sites. Numbers were summed over twenty five 25-sweep samples.

Other Measures

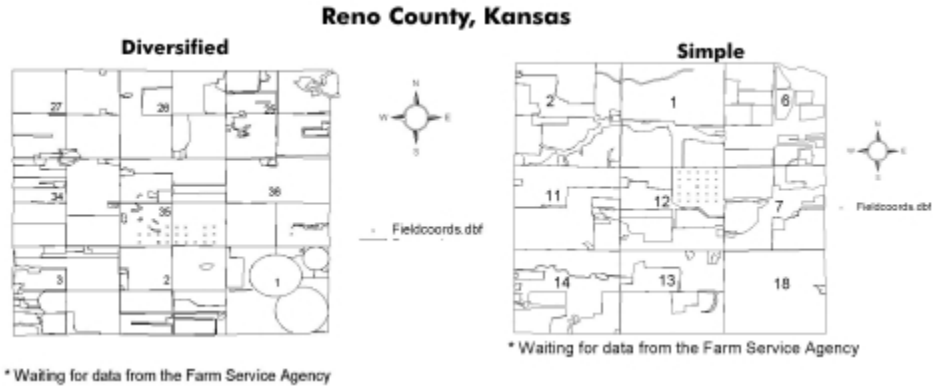
Weeds. In general weeds were found at low-to-moderate levels in all of the fields evaluated, and no significant differences were observed between diverse and simple sites. Data is continuing to be summarized.

Arthropods in alternative crops. In sorghum, aphids were present at all sites, but were severely reduced by parasitism (*L. testaceipes*). This primary parasitoid is the same that attacks aphids in wheat. The high levels of parasitism throughout the sorghum growing season suggests that *L. testaceipes* is conserved in diverse systems.

In cotton (at the Jackson Co. diverse site), cotton aphids built up quickly after planting, but were dramatically suppressed by an abundance of predators. Ladybeetles were observed to be the primary predators. Parasitism of cotton aphids by *L. testaceipes* was not observed. Data from sorghum and cotton fields is continuing to be summarized.

e. Kansas Demonstration Site

Phase II, Year 1 (2002-2003)
Prepared by Michal Roberts



Kansas had two field sites located in Reno County, Kansas. One (wheat only) represented an area in which a large percentage of the wheat is grown continuously. The other (diversified area) was located in an area where wheat is often rotated with other crops (sorghum, sunflowers, soybeans) in a more diversified cropping system. In fall 2002, both fields were mapped and gridded with 25 grid points and 4 benchmark areas. In the diversified area wheat was planted into wheat stubble, followed by sorghum. The fall 2003 wheat planting was made in a field planted to soybeans in the summer 2003.

Soil samples for soil fertility assessment and available soil moisture were taken at planting. Dr. Peeper of Oklahoma State University made the weed assessments in both fields. Fields were sampled for pest and beneficial insects at biweekly intervals throughout the growing season, weather permitting. Data was placed into a handheld unit and problems were encountered in retrieving the data due to corrupted software. This technical difficulty is currently being address by the software company.

Although our data is currently trapped in a software glitch, we detected no pest pressure in either field. There were only a few greenbugs (GB) and bird cherry oat aphids (BCOA) noted throughout the season. No Russian wheat aphids were found. Initially in the spring we detected no pests, and a few beneficial insects. Later in the season (late May to early June), beneficial insect and spiders were present in significant numbers; however, only a few or no aphids or parasitoids were present.